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A. B. CONNER, DIRECTOR

COLLEGE STATION, BRAZOS COUNTY, TEXAS

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DIVISION OF RURAL HOME RESEARCH

Some Body Measurements of Texas School Children

AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS

T. O. WALTON, President

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It is generally agreed that the status of bodily growth and nutrition of children may be judged in part by the degree to which recognized standards of body size and proportions are met. But standards are not yet finally determined even for white children, about whom there is more information than about other races. This study with Mexican, white, and negro school children in San Antonio, Texas, shows among them both striking similarities in certain aspects of average size and rates of growth, and characteristic differences in other aspects. The differences observed emphasize the need of separate racial standards, and this study contributes data that may be used in developing standards.

Over 7300 measurements each of weight, standing height, and sitting height, and approximately 3000 each of shoulder width and hip width were made upon 928 white, 790 Mexican, and 725 negro school children.

These characteristic differences were noted:

While the white and Mexican children were very similar to each other in their rates of growth in each of the five measurements, these two races were exceeded in every rate by the negro, except in hip width of boys, which was the same in all three races.

Larger weight gains between 10 and 14 years than for other ages although noticeable for all races were more conspicuous with Mexican and negro children than with the white.

There were more marked differences between the average measurements of negro boys and girls than between either the white boys and girls or the Mexican boys and girls.

Negro children were shorter in standing height and lighter in weight than white children from 7 to 9 or 10 years old, but above 10 years the negroes were the taller and heavier. In sitting height, however, negroes were the shorter at all ages. Negroes were broader of shoulder and narrower of hip than white children.

Mexican children were shorter than white children of the same age, in both standing height and sitting height; Mexicans were lighter in weight, and slightly narrower through the shoulders and hips.

Mexican children, compared with negroes of the same age, were lighter in weight, shorter in standing height, narrower in shoulder width, but similar in both sitting height and hip width.

These striking similarities were found:

For all races the rate of growth was much the fastest in weight, followed in order by hip width, standing height, shoulder width, and sitting height.

The variation in weight was approximately 2 to 3 times as great as for width of shoulders and of hips, and approximately 3 to 4 times as great as for standing height and sitting height.

In all races girls under 10 or 11 years weighed less and were shorter in both standing height and sitting height than boys of the same age; from 10 or 11 until 14 or 15 years, girls exceeded boys in these measurements, but thereafter girls were again smaller than boys. Shoulder widths were similar for boys and girls of the same age in each race; but when not the same, the boys exceeded the girls except among 12- and 13-year-old negroes. Girls above 8 or 9 years were wider through the hips than boys of the same race; and these differences were more pronounced after 11 or 12 years of age.

Girls of each race varied more among themselves in each measurement than did the boys.

Obviously growth standards for white children should not be used for Mexican or negro children.

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SOME BODY MEASUREMENTS OF TEXAS SCHOOL CHILDREN

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Despite the vast amount of attention given, especially in the last 30 years, to the subject of human body growth and nutrition, accurate information is still far from complete. There is a great lack of facts regarding the physical development and evidences of well-being of children in the socio-economic classes represented by pupils in the public elementary and high schools. Comparable data on children from different race groups are very meagre, although different race groups have been included in the population since an early date in our history.

To contribute to the filling in of these gaps in our knowledge, a study based on selected body measurements and judgment of the physical well-being of Mexican, white, and negro school children† was made with the coöperation of three public schools of San Antonio. That the three race groups lived in the same city and were measured within the same period of time constitutes a distinctive feature of this study; comparability of data is thereby enhanced.

The findings relating to seasonal variations of growth in weight and standing height have been published in Bulletin 510 by the Texas Station. This present report based upon records of the five body measurements made of each child presents comparative pictures, between boys and girls in each race and between the three race groups, of the size, certain aspects of body build, and average rates of growth. Such information is useful in developing some of the criteria by which progress in children's growth may be judged, and need for separate racial standards is emphasized by the findings here reported.

DATA USED

Nature of Material

The collection of data extended over a period of two and one-half school years (January 1929-May 1931). The elementary supervisors selected the schools as representative both of the three races and the public school population of San Antonio. No attempt was made to determine the degree of purity of race stock. The negroes were regarded as typical of the American negro. Mexicans were classified as such on the basis of indicative name together with the birth-place of the child's parents. The parents

*Credit for assisting in collecting the data for this study is due Miss Emma E. Sumner and Miss Elizabeth D. Terrill, former members of the staff.

†The children included in this study, all citizens of the United States, have been classified into three groups—Mexicans, other whites, and negroes. As a matter of convenience, these groups are referred to as race groups, and for the sake of brevity in this Bulletin the designation "white" is used for the second of these groups.

of most of the white children were born in the United States, making this group, in the main, second-generation American. To effect greater homogeneity among the records used, those of the few Hebrew, Italian, Greek, Russian, and Syrian pupils were eliminated, as were also those of the few Chinese children. There were approximately 500 children in each school in the study each year. This number included all the pupils in the white and negro schools. In the Mexican school with over 1000 enrolled, the same children, in so far as feasible, were retained as subjects throughout the time of collecting data. The white and Mexican pupils were distributed through the first five grades (elementary schools of Texas) and the negro through the first eight grades (elementary and junior high schools of Texas). The extent of the data with respect to the number of pupils and number of body measurements is shown in Table 1.

Table 1. Number of cases used in this report

	White Children			Mexican Children			Negro Children		
	7–13 Years			8–15 Years			7–17 Years		
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total
No. of individuals	494	434	928	421	369	790	358	367	725
No. of measurements:									
Weight	1394	1199	2593	1126	1188	2314	1246	1285	2531
Standing height	1394	1199	2593	1126	1188	2314	1246	1285	2531
Sitting height (stem length)	1394	1198	2592	1122	1187	2309	1245	1285	2530
Shoulder width	631	530	1161	436	444	880	464	507	971
Hip width	632	530	1162	436	444	880	463	506	969

While the pupils were weighed once each month of the school year during the period in which data were collected, height was measured only once each semester, or five times in all, at intervals of 5 to 9 months. In this report there are used for each child only those weights that were determined on the same day as height measurement. Each child was counted as many cases as he had different classifications of year-of-age (to the nearest birthday) and (or) inch-of-height (standing). Thus some children represent but one case in body measurement; others, 2, 3, 4, or 5 cases as determined by the number of changes in their age and standing height. Width of hips and of shoulders was measured once for each child and twice for a few of them; but the second of such measurements was used only if the child had in the time interval between these measurements become a new case by reason of increased year-of-age or inch-of-height.

Methods of Securing Data

All weights were determined to the nearest ounce on a Continental scale of platform type, the weighing being done at approximately the same hour of day for each group, the child having the urinary bladder empty and wearing a weighing garment. The weight of the garment was subtracted from the weight of child plus garment to give the nude weight.

The Baldwin measuring tape fastened to a specially constructed board was used for determining standing and sitting heights. This board was held firmly in a perpendicular position to one end of the bench specially constructed for use in measuring sitting height (stem length). The technique of Baldwin (3) as modified by Roberts (34) was followed for standing height, and for sitting height, the technique of Dreyer and Hanson (16) with the modifications that the child placed palms instead of backs of hands on the board to help place himself in position and that minor details in instruction to be given to the child were added by the project leaders. Width of hips (greater trochanter, the landmark) and of shoulders was measured with metal calipers secured from the Smithsonian Institution and used according to Baldwin's technique demonstrated to the author by a member of Dr. Baldwin's staff in the Iowa Child Welfare Research Station. Selected steps in the measurement of weight, standing height, sitting height, shoulder width, and hip width are illustrated in Figures 1, 2, and 3.

Fig. 1. Typical set-up for measuring weight, standing height, and sitting height in the weighing room at the Mexican school. The observer at the weighing scale recorded all measurements. The assistant, at the right, brought the pupils from the class room, assisted them in donning the weighing garments, and organized the line of children. Weighing garments, after use, were put into the laundry bag on the chair back at the right.

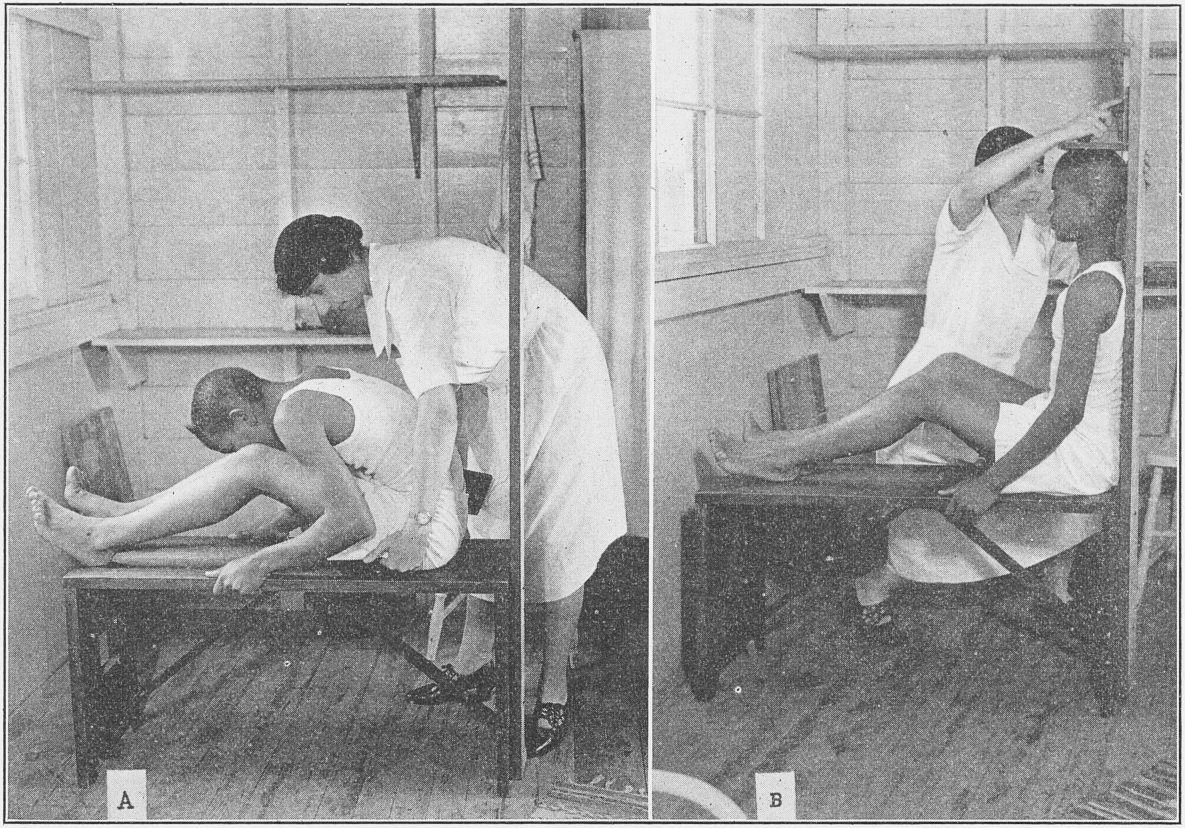

Fig. 2. Measuring sitting height. The second observer recorded the height.

A. At this point in the procedure the child has followed the directions: sit on the bench; bend your knees and your ankles; put your chin between your knees; now push back till your hips touch the measuring board. The observer pulled the child back against the board if he did not push himself into correct position.

B. The child with knees and ankles flexed but relaxed, with hands lying on the bench or hanging at his side, with hips, shoulders, and back of head against the measuring board, and eyes looking straight forward, sat as tall as possible. The height was read from the under side of the square held firmly upon his head.

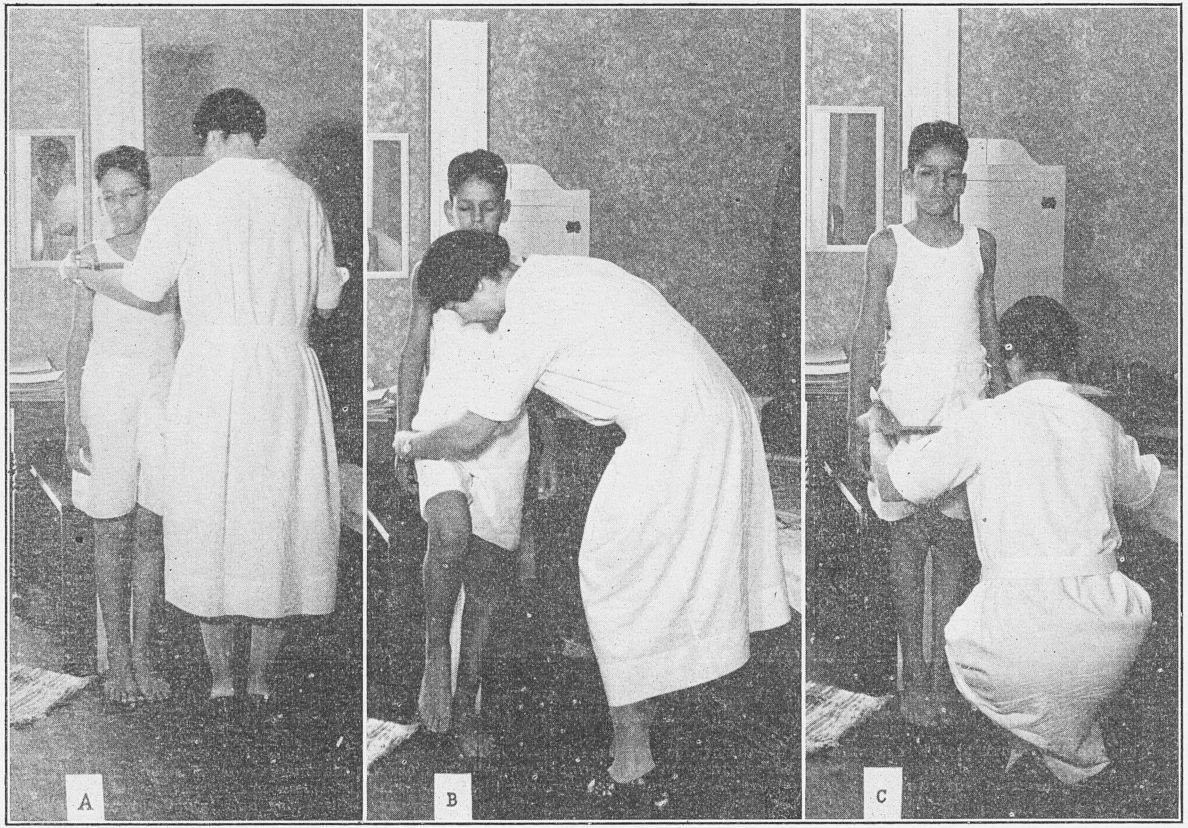

Fig. 3. Measuring shoulder width and hip width. Recording was done by the second observer.

The child with the measuring board at his back, could the more easily stand still and relaxed and hold his shoulders in good position.

A. The arms of the sliding metal calipers were placed over the greater tuberosities of the humeri and held firmly against the flesh.

B. Bending the knee and raising it toward the observer's chin aided in locating the greater trochanter.

C. The arms of the sliding metal calipers were held firmly upon the greater trochanter with only the material of the pants between the metal and the child's skin.

MEAN MEASUREMENTS

For Boys and Girls According to Year-of-Age in Each Race

The most accurate picture of growth would, of course, be secured by following the **same** children through the entire series of years of age covered by a given study. This study is a compromise between this ideal procedure and that in which a large number of individuals is measured but once and group averages then derived for the several age groups. A small proportion of these children—14 per cent of negro, 23 per cent of Mexican, and 29 per cent of white—were measured only one time; and they constitute of the entire number of cases, only 4 per cent of the negro, 8 per cent of the Mexican, and 10 per cent of the white. Since the collection of data extended over a calendar period of 3 years 5 months, one child could be at most in four different age groups, and never throughout the entire series of year-of-age groups for any race. As is commonly done in such studies, the assumption has been made that the actual facts are closely enough approximated by these data for groups in consecutive years of age (to nearest birthday) to permit some generalizations upon the dimensions considered and the growth of these children living in the same city.

The number of boys and girls in each year-of-age group (hereafter called "age group") of each race is shown in Table 2 for each of the five body measurements made. For each group having 20 or more cases, the mean was calculated and is recorded in Table 3. A graphic presentation of the mean of each measurement for consecutive age groups of boys and of girls in each race is given in Figures 4 and 5.

Table 2. Number of cases according to year-of-age for each of five body measurements

Race	Age*	Weight		Standing height		Sitting height		Shoulder width		Hip width	
	Years	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
White	7	109	127	109	127	109	126	47	44	47	44
	8	230	221	230	221	230	221	95	86	95	86
	9	267	248	267	248	267	248	113	113	113	113
	10	325	270	325	270	325	270	140	99	140	99
	11	287	203	287	203	287	203	135	108	135	108
	12	125	106	125	106	125	106	75	69	76	69
	13	51	24	51	24	51	24	26	11	26	11
	Total	1394	1199	1394	1199	1394	1198	631	530	632	530
Mexican	8	65	47	65	47	65	47	34	21	33	21
	9	128	110	128	110	128	110	53	44	53	44
	10	170	220	170	220	167	219	72	84	72	84
	11	234	268	234	268	234	268	85	94	86	94
	12	221	246	221	246	220	246	64	89	64	89
	13	152	182	152	182	152	182	60	67	60	67
	14	100	78	100	78	100	78	43	30	43	30
	15	56	37	56	37	56	37	25	15	25	15
	Total	1126	1188	1126	1188	1122	1187	436	444	436	444
Negro	7	42	30	42	30	42	30	10	12	10	12
	8	104	99	104	99	104	99	36	35	36	35
	9	145	141	145	141	145	141	43	44	42	44
	10	151	159	151	159	150	159	60	69	60	69
	11	135	149	135	149	135	149	54	57	54	57
	12	140	176	140	176	140	176	49	71	49	70
	13	144	159	144	159	144	159	59	62	59	62
	14	150	146	150	146	150	146	55	63	55	63
	15	127	117	127	117	127	117	45	47	45	47
	16	81	82	81	82	81	82	40	35	40	35
	17	27	27	27	27	27	27	13	12	13	12
	Total	1246	1285	1246	1285	1245	1285	464	507	463	506

*Nearest birthday.

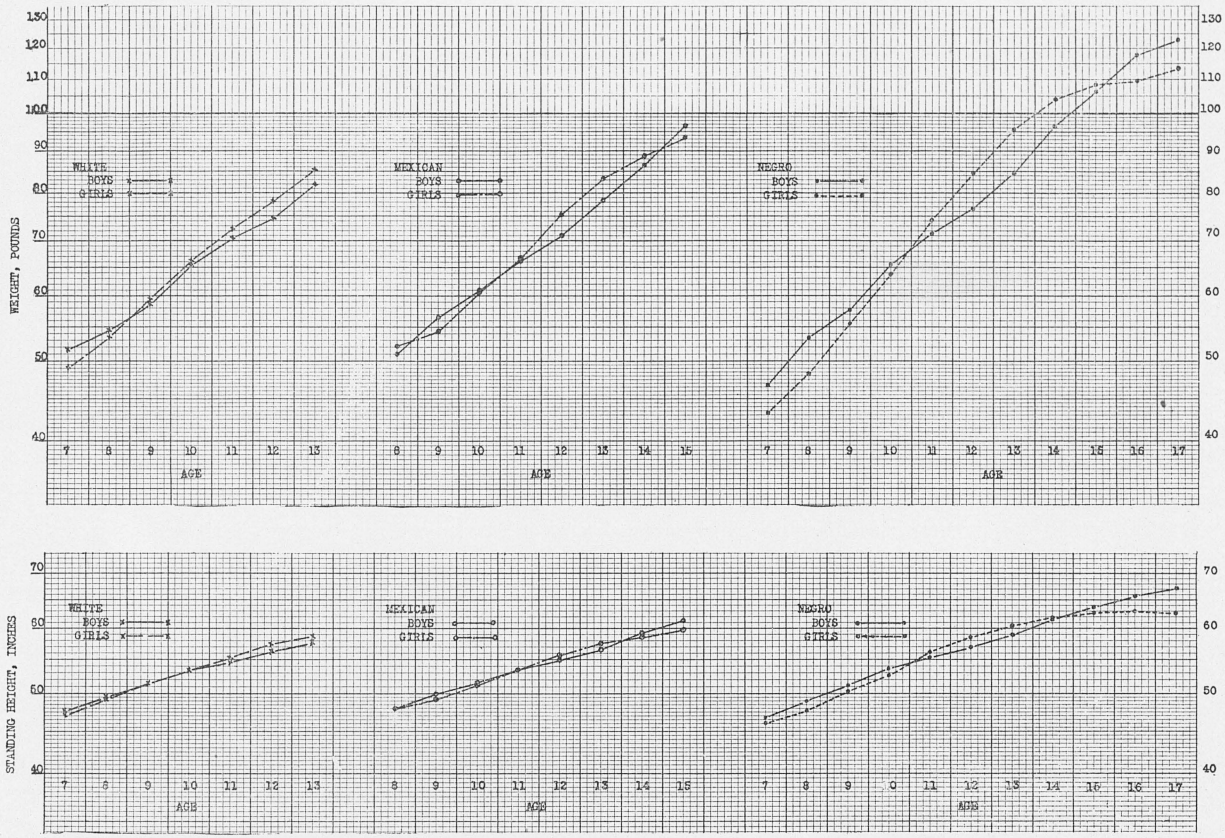

Fig. 4. Mean weight and standing height for consecutive age groups of boys and of girls in each race. The steeper the slope of the line, the faster the rate of increase.

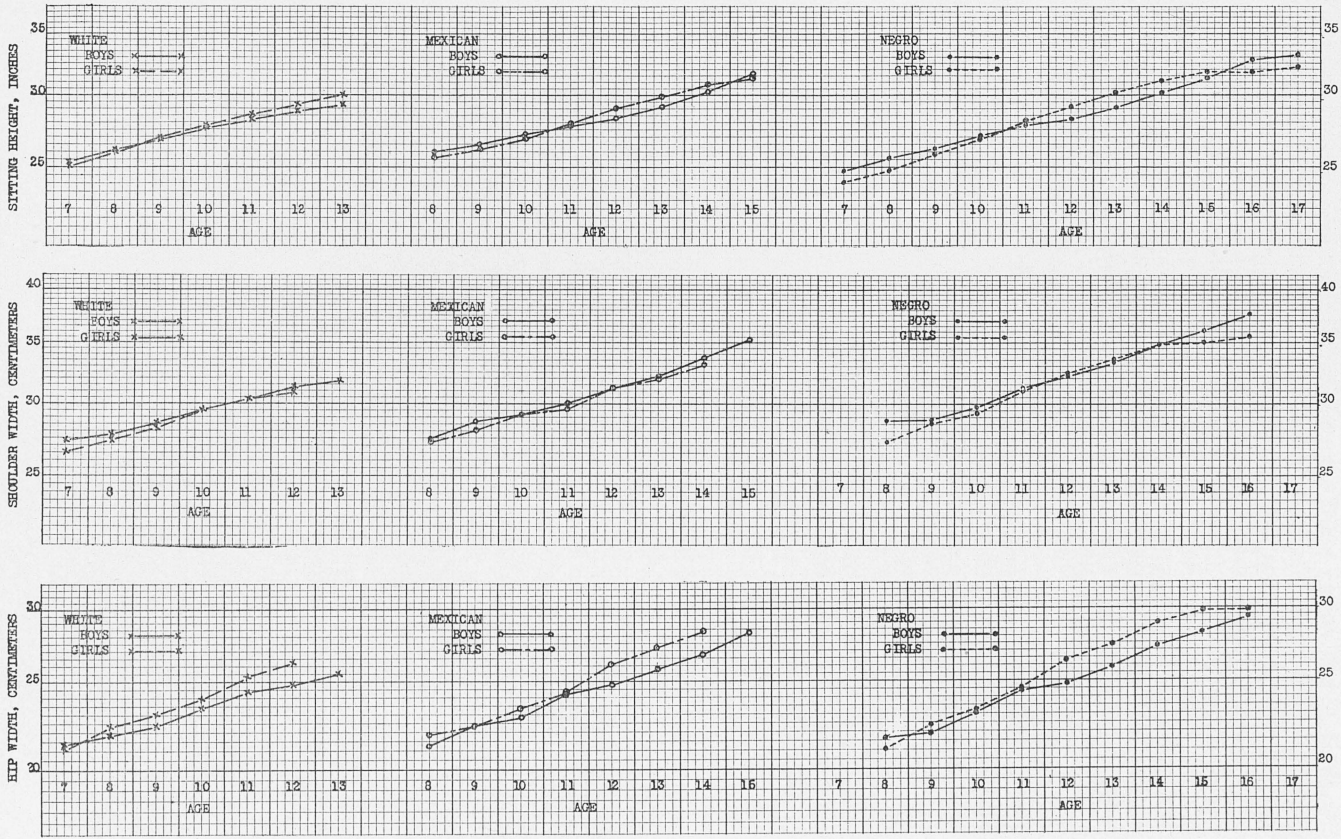

Fig. 5. Mean sitting height, shoulder width, and hip width for consecutive age groups of boys and of girls in each race. The steeper the slope of the line, the faster the rate of increase.

Table 3. Mean measurements* of children grouped according to age

Race	Age, years	Weight, pounds		Standing height, inches		Sitting height, inches		Shoulder width, centimeters		Hip width, centimeters		Age, years
		Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	
White	7	51.42±0.50	49.21±0.76	47.89±0.12	47.21±0.11	25.45±0.07	25.17±0.06	27.43±0.14	26.52±0.13	21.40±0.11	21.16±0.11	7
	8	54.46±0.33	53.46±0.36	49.57±0.09	49.19±0.10	26.20±0.05	26.05±0.05	27.87±0.10	27.72±0.10	21.72±0.09	22.36±0.10	8
	9	58.78±0.32	59.72±0.42	51.31±0.09	51.25±0.10	26.88±0.05	26.94±0.05	28.58±0.10	28.21±0.12	22.44±0.08	23.05±0.10	9
	10	65.31±0.40	66.22±0.52	53.27±0.09	53.30±0.10	27.66±0.05	27.74±0.06	29.61±0.09	29.65±0.12	23.39±0.07	23.95±0.12	10
	11	70.75±0.48	72.51±0.62	54.95±0.10	55.25±0.13	28.28±0.05	28.56±0.07	30.45±0.10	30.42±0.13	24.38±0.09	25.28±0.13	11
	12	74.52±0.71	78.25±0.91	56.26±0.15	57.26±0.21	28.72±0.07	29.42±0.11	31.25±0.15	30.88±0.17	24.99±0.13	26.17±0.16	12
	13	82.06±1.25	86.25±2.03	57.90±0.28	58.46±0.47	29.39±0.12	30.04±0.31	31.77±0.28	.....	25.54±0.23	.....	13
Mexican	8	51.00±0.61	52.13±1.17	48.11±0.20	48.00±0.25	26.02±0.07	25.60±0.11	27.38±0.19	27.33±0.32	21.27±0.15	21.81±0.29	8
	9	56.84±0.64	54.32±0.69	50.09±0.13	49.40±0.12	26.50±0.07	26.17±0.08	28.74±0.14	28.07±0.17	22.30±0.12	22.32±0.16	9
	10	61.03±0.55	60.61±0.58	51.79±0.11	51.24±0.10	27.17±0.06	26.97±0.05	29.22±0.13	29.18±0.14	22.93±0.10	23.44±0.12	10
	11	66.09±0.48	66.27±0.50	53.43±0.10	53.43±0.11	27.74±0.05	27.95±0.06	30.04±0.12	29.68±0.14	24.16±0.11	24.30±0.14	11
	12	71.09±0.54	75.14±0.63	55.01±0.11	55.62±0.12	28.32±0.10	29.01±0.07	31.28±0.15	31.30±0.14	24.98±0.14	26.15±0.14	12
	13	78.22±0.77	83.16±0.99	56.96±0.15	57.41±0.14	29.18±0.08	29.93±0.08	32.23±0.20	32.00±0.15	25.72±0.15	27.31±0.16	13
	14	86.50±0.97	88.85±0.94	59.27±0.18	58.67±0.18	30.32±0.11	30.87±0.09	33.81±0.22	33.17±0.28	26.72±0.18	28.37±0.28	14
	15	96.96±1.29	93.11±1.33	61.16±0.24	59.97±0.23	31.63±0.14	31.43±0.12	35.36±0.33	.....	28.40±0.25	.....	15
Negro	7	46.79±0.90	43.33±0.91	46.98±0.33	46.03±0.33	24.88±0.15	24.07±0.15	.....	.....	.....	.....	7
	8	53.17±0.65	48.33±0.48	49.08±0.21	47.78±0.16	25.54±0.10	24.79±0.07	28.75±0.19	27.29±0.20	21.64±0.17	21.03±0.15	8
	9	57.79±0.56	55.46±0.46	51.13±0.17	50.38±0.14	26.24±0.07	25.85±0.07	28.86±0.22	28.70±0.19	21.98±0.18	22.30±0.16	9
	10	65.56±0.58	63.84±0.76	53.65±0.15	52.93±0.15	27.09±0.07	26.86±0.07	29.97±0.18	29.48±0.18	22.98±0.12	23.23±0.15	10
	11	71.52±0.57	74.13±0.78	55.27±0.16	56.10±0.17	27.70±0.07	28.13±0.08	31.30±0.17	31.21±0.17	24.28±0.13	24.47±0.15	11
	12	76.82±0.62	84.89±0.81	57.03±0.16	58.54±0.15	28.34±0.06	29.23±0.07	32.16±0.15	32.49±0.15	24.73±0.12	26.29±0.16	12
	13	84.90±0.75	95.72±0.86	59.06±0.16	60.53±0.13	29.03±0.08	30.26±0.07	33.36±0.18	33.63±0.19	25.68±0.14	27.74±0.19	13
	14	96.47±0.83	104.11±0.89	61.60±0.12	61.87±0.13	30.26±0.07	31.08±0.07	34.85±0.21	34.73±0.17	27.16±0.18	28.90±0.14	14
	15	106.42±0.88	108.03±0.83	63.86±0.16	62.74±0.15	31.43±0.08	31.71±0.09	36.16±0.22	35.04±0.18	28.24±0.17	29.83±0.19	15
	16	117.59±1.00	109.45±1.01	65.88±0.19	63.00±0.20	32.72±0.11	31.77±0.14	37.63±0.19	35.51±0.19	29.48±0.18	29.74±0.19	16
	17	123.15±2.14	112.78±2.30	67.07±0.38	62.89±0.27	33.22±0.18	32.15±0.19	.....	.....	.....	.....	17

*With probable error.

The use of a semi-logarithmic scale for these graphs makes it possible to compare directly the rate of increase from age group to age group in the several measurements regardless of difference in the units in which the measurements themselves were made, since equal vertical distances represent equal percentage increases. Lines with the same slope show the same rate of increase, and the steeper any line the faster the rate. The English units in which standing height and sitting height were measured are retained because they are still commonly used in the United States. However, in recent studies, metric units are more common for hip width and shoulder width, and therefore these measurements are used as taken, in centimeters.

Relative Rates of Increase in the Means of Five Body Measurements

The graphs in Figures 4 and 5 show clearly that for all groups the rate of increase is much the greatest in the case of weight, a three-dimensional magnitude while the other four measurements were one-dimensional. Rates of increase for the other four body dimensions stand in general in this descending order—hip width, standing height, shoulder width, sitting height. The only exceptions to this general order (boys being compared with boys and girls with girls in each case) are that the rate of increase in standing height of white boys and negro boys slightly exceeds their respective rates of increase in hip width; the rates for standing height and shoulder width are practically the same for Mexican children; and the rates for sitting height and shoulder width are practically the same for the white children.

Comparison Between Boys and Girls with Respect to Each Mean Measurement and Respective Rates of Increase

With each measurement, strikingly similar differences between boys and girls are exhibited by the three races.

Weight. White girls under 9 years old, negro girls under 11 years, and Mexican girls of 9 and 10 years weigh less than the boys of the same age and race. Above these ages, girls weigh more than boys up to 13 years for white children—the oldest age group of this race studied, up to 14 years for Mexicans, and to 15 years for negroes. Boys exceed girls in weight at the higher ages by reason both of an acceleration in the boys' rate (noticeable at 14 years for Mexican, and well-marked from 12 to 16 years for negroes) and a decline in the girls' rate beginning at 13 years. At 15 years for Mexican children and at 16 and 17 years for negro, the weight of girls is less than that of the boys in corresponding groups, and presumably it will remain less. Evidently, Mexican and negro boys and girls interchange relative positions in weight at certain ages, as was found to be true for white children in pioneer studies (9, 32, 33) of human growth.

Standing Height and Sitting Height. The same type of differences between boys and girls with respect to standing height and sitting height as for weight is seen in the graphs for negroes, except that the girls' standing height drops below that of the boys at 15 years, one year earlier that with weight and sitting height. An inconspicuous but consistent similarity can be noted for the means of standing and sitting heights of Mexican boys and girls, compared with means of weight. With white children only close scrutiny reveals the similarity between the curves for standing height and sitting height compared to those for weight. Far more impressive than differences shown in the height graphs is the closeness of the means for the white boys and girls in each age group and hence the like rates of increase by boys and girls in standing height and in sitting height.

Shoulder Width. The means of shoulder width for boys compared with girls in each race are noteworthy for their close or equal value in each age group, exceptions being only at 7 years with white children, and 8, 15, and 16 years with negro. However, in those age groups showing differences, mean values for boys consistently exceed those of the girls in the same race, with the exception that negro girls have a slightly greater shoulder width than boys at 12 and 13 years.

Hip Width. The conspicuous feature for hip width, as shown by the graphs, is the uniformly higher means for girls than for boys from 8 years onward for white and Mexican (except for equal value at 9 years for Mexican boys and girls) and from 9 years onward for negro. The differences are greater at 11 and 12 years for white, and from 12 years on for Mexican and negro children than at earlier ages. Only among the negroes, for whom data extend as high as 16 years, do the graphs for hip width of boys and girls tend to converge in the upper age groups.

Significance of Difference Between Mean Measurements of Boys and Girls in Each Race

A comparison of the mean measurements for boys and girls in terms of difference of means in relation to the probable error of the difference may be made with the aid of Table 4. Differences which are certainly significant statistically (4 or more x P. E.) or almost certainly significant (3 x P. E.) occur in the case of weight, standing height, and sitting height for one or more but never all age groups in each race between 10 and 14 years. Negroes have the largest proportion of significant differences in these years. Also, most of the other age groups of negroes have critical ratios of 3 or more in weight, standing height, and sitting height. But among the other age groups of Mexican children, differences in these three measurements are significant only for standing height at 9 and 15 years, and for sitting height only at 8 and 9 years. Among white children of other age groups, only at 7 years for standing height and for sitting height are differences significant. It appears therefore that boys and girls of the same age in the negro race differ more markedly from each other in respect to

mean weight, mean standing height, and mean sitting height than they do in the Mexican and white races.

Table 4. Significance of difference between mean measurements of boys and girls in each race

Race	Age, years	Difference of means ÷ probable error of the difference*				
		Weight	Standing height	Sitting height	Shoulder width	Hip width
White	7	2.43	*4.25*	*3.11*	*4.79*	1.50
	8	2.04	2.92	2.14	1.07	*4.15*
	9	1.77	0.46	0.86	2.31	*4.69*
	10	1.38	0.23	1.00	0.27	*4.00*
	11	2.26	1.88	*3.11*	0.19	*5.63*
	12	*3.24*	*3.85*	*5.38*	1.61	*5.62*
	13	1.78	1.04	1.97	.....	.....
Mexican	8	0.86	0.34	*3.23*	0.14	1.69
	9	2.68	*3.83*	*3.00*	*3.05*	0.10
	10	0.53	*3.67*	2.50	0.21	*3.19*
	11	0.26	0.00	2.63	2.00	0.78
	12	*4.88*	*3.81*	*5.75*	0.10	*5.85*
	13	*3.95*	2.14	*6.82*	0.92	*7.23*
	14	1.74	2.40	*3.93*	1.78	*5.00*
	15	2.08	*3.61*	1.11	.....	.....
Negro	7	2.70	2.02	*4.76*	.....	.....
	8	*5.98*	*5.00*	*6.25*	*5.21*	2.65
	9	*3.19*	*3.41*	*3.90*	0.55	1.33
	10	1.79	*3.43*	2.30	1.96	1.32
	11	2.78	*3.61*	*3.91*	0.38	0.95
	12	*7.91*	*6.86*	*9.89*	1.57	*7.30*
	13	*9.49*	*7.00*	*11.18*	1.04	*8.58*
	14	*6.26*	1.50	*8.20*	0.44	*7.57*
	15	1.33	*5.09*	2.33	*4.00*	*6.36*
	16	*5.73*	*10.29*	*5.28*	*7.85*	1.00
	17	*3.36*	*9.09*	*4.28*	.....	.....

*Quotients of 3 or more, almost certainly significant, and of 4 or more, certainly significant, are in italics.

Significant difference between boys and girls occurs least frequently in shoulder width, only 7-year-old white children, 9-year-old Mexican children, and 8-, 15-, and 16-year-old negro children having a difference between boys and girls as great as 3 or more times the probable error. In contrast, hip width shows the most consistent significant differences between sexes when all measurements and the three races are taken into account. Beginning at 8 years for white children, 10 years for Mexican, and 12 years for negro (with exception of 11-year-old Mexican and 16-year-old negro), the upper age groups of boys and girls differ significantly in hip width, all critical ratios but one being 4 or more. Significant differences between white boys and girls are far more conspicuous for hip width than for any other of their measurements.

Variation in Body Measurements

Between Age Groups. The variability in body measurements as indicated by the coefficient of variation is shown in Table 5. Here it is apparent that weight is by far the most variable of the five measurements. Within each race, for each age group, the coefficient of variation for weight is approximately 2 to 3 times as large as the coeffi-

cients of variation for shoulder width and hip width, and approximately 3 to 4 times those for standing height and sitting height in corresponding groups. There appears to be some tendency, though not a perfectly consistent one, for the age groups of 10 to 14 years to show somewhat higher coefficients of variation in weight than do other age groups.

Table 5. Variability in body measurements as shown by the coefficient of variation*

Race	Age, years	Coefficient of variation									
		Weight		Standing height		Sitting height		Shoulder width		Hip width	
		Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
White	7	15.07	12.09	3.95	3.94	4.32	3.66	5.14	4.79	5.23	5.34
	8	13.59	14.96	4.05	4.43	4.05	3.95	5.31	5.16	5.66	5.86
	9	13.35	16.24	4.27	4.72	4.09	4.23	5.70	6.45	5.70	7.03
	10	16.18	19.30	4.30	4.75	4.34	4.97	5.47	6.00	5.47	7.64
	11	17.17	18.14	4.51	5.05	4.21	5.18	5.91	6.54	6.69	8.07
	12	15.77	17.70	4.50	5.50	4.07	5.47	6.34	6.77	6.56	7.34
	13	16.15	16.75	5.20	5.70	4.25	7.42	6.48	.....	6.54	.....
Mexican	8	14.41	22.73	4.97	5.27	3.34	4.53	6.06	7.87	6.16	8.67
	9	19.00	19.70	4.31	3.89	4.23	4.70	5.29	5.91	5.74	7.26
	10	17.30	21.15	4.19	4.47	3.97	4.23	5.61	6.34	5.41	6.78
	11	16.49	18.33	4.34	5.05	3.97	5.04	5.43	6.74	6.17	8.31
	12	16.60	19.56	4.51	5.09	4.59	5.27	5.53	6.26	6.57	7.53
	13	18.03	23.75	4.79	4.86	4.93	5.18	6.95	5.88	6.77	7.25
	14	16.59	13.79	4.52	3.94	5.21	3.85	6.27	6.78	6.59	8.07
	15	14.75	12.83	4.27	3.49	4.77	3.44	6.73	.....	6.51	.....
Negro	7	18.49	16.96	6.66	5.89	5.71	5.15	.....	.....	.....	.....
	8	17.62	14.79	6.62	5.06	5.95	4.32	5.88	6.41	7.16	6.18
	9	17.22	14.61	5.93	4.94	4.84	4.49	7.45	6.34	8.05	6.86
	10	15.99	22.24	5.14	5.31	4.69	4.80	6.91	7.36	6.05	8.05
	11	13.77	19.02	5.07	5.33	4.62	5.08	5.94	6.22	5.81	7.03
	12	14.25	18.73	4.82	5.11	3.95	4.62	4.79	5.88	5.22	7.68
	13	15.78	16.72	4.83	4.15	4.93	4.03	6.03	6 69	6.35	7.93
	14	15.60	15.32	4.42	3.77	4.49	3.83	6.48	5.82	7.22	5.85
	15	13.81	12.36	4.20	3.81	4.49	4.44	5.97	5.37	5.84	6.64
	16	11.35	12.38	3.75	4.32	4.40	5.73	4.70	4.79	5.73	5.48
	17	13.11	15.43	4.29	3.28	4.03	4.39	.....	.....	.....	.....

* coefficient of variation $= \frac{\text{standard deviation} \times 100}{\text{mean}}$

The best defined tendency among these measurements in relation to age groups is in standing height of white and of negro children. With white children these coefficients **increase** slightly but regularly throughout the entire series of age groups, from younger to older (except 12-year boys' coefficient of variation is .01 less than 11-year), while with negro children the gradation of values is in the opposite direction, coefficients **decreasing** from the 7-year through the 16-year groups regularly for negro boys (except 13-year coefficient of variation is .01 greater than 12-year) and with but slight departure from regularity for negro girls.

There is an increase with age, not wholly consistent, in coefficients of variation for shoulder width, and for hip width of white boys and girls, and for sitting height of white girls; but there is no consistent gradation of values for sitting height of white boys, or for any of these three measurements of Mexican and negro children.

Between Boys and Girls. In general, girls are more variable than boys in each of the five measurements (Table 5). Coefficients of variation are higher for white girls than boys from 7, 8, or 9 years to 13 years, the end of the age series in this study. Mexican girls vary more than do boys from the 8-year to the 13- or 14-year group, except at 9 years for standing height and at 13 years for shoulder width. Negro girls vary more in all measurements than do boys from 10 to 12 or 13 years, in hip width at 15 years, in standing height and sitting height at 16 years, and in shoulder width at 16 and 8 years.

Since the pubertal period of boys begins and ends a year or two later than for girls, the higher coefficients of variation for Mexican and negro boys at 14 and 15 years is probably in part an expression of the later influence of factors affecting this period of development with boys. For a similar reason probably, the variability of the girls among themselves shows the greatest excess over the variability among the boys at 10 to 13 years, the girls' pubescent period. But some other factors must also be operating, since white girls of 7 to 9 years, Mexican girls of 8 and 9 years, and negro girls of 16 and 17 years show greater variability than do boys of the same age. Why the relative variabilities of younger negro boys and girls were different from those of boys and girls of the other two race groups is a question. Conjecture includes the possibility of an inherent race difference; but the caution given by Todd (40) that differences found in skeletal maturation should not be attributed to "natural" variation without a careful search for the possible definite causes seems applicable in this instance. There may have been a difference in environmental factors, even though the three race groups lived in the same city and were measured in the same period of time. Information on environmental factors afforded by this study is too meagre, however, to justify suggesting that they may have been the cause for the observed racial difference.

Growth per Year

The annual gain in each of the five measurements made by the boys and by the girls in each race was calculated by subtracting from the mean measurement of each age group the mean of the next younger age. Each difference expressed as a per cent of the corresponding mean measurement at the younger age shows the percentage annual gain. These absolute and percentage gains are recorded in Table 6. The data in Table 6 show an impressive similarity between the fluctuations in the relative gains of boys and girls with increasing age, and the influence of sex on skeletal maturation as summarized by Todd (40). The similarity is more consistent between these two aspects of growth with the white and negro children than with the Mexican. With limitation of the comparison to the age groups in this study, in general, the gains of girls are greater than those of boys before 9 years of age, corresponding to skeletal acceleration shown by girls in this age period; between 9 and 10 years boys and girls have approximately the same

Table 6. Growth per year, calculated from mean measurements

Race	Age interval, years	Gain in absolute amounts										Gain as per cent of mean at younger age									
		Weight, pounds		Standing height, inches		Sitting height, inches		Shoulder width, centimeters		Hip width, centimeters		Weight		Standing height		Sitting height		Shoulder width		Hip width	
		Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
White	7– 8	3.04	4.25	1.68	1.98	0.75	0.88	0.44	1.20	0.32	1.20	5.91	8.64	3.51	4.19	2.95	3.50	1.60	4.52	1.50	5.67
	8– 9	4.32	6.26	1.74	2.06	0.68	0.89	0.71	0.49	0.72	0.69	7.93	11.71	3.51	4.19	2.60	3.42	2.55	1.77	3.31	3.09
	9–10	6.53	6.50	1.96	2.05	0.78	0.80	1.03	1.44	0.95	0.90	11.11	10.88	3.82	4.00	2.90	2.97	3.60	5.10	4.23	3.90
	10–11	5.44	6.29	1.68	1.95	0.62	0.82	0.84	0.77	0.99	1.33	8.33	9.50	3.15	3.66	2.24	2.96	2.84	2.60	4.23	5.55
	11–12	3.77	5.74	1.31	2.01	0.44	0.86	0.80	0.46	0.61	0.89	5.33	7.92	2.38	3.64	1.56	3.01	2.63	1.51	2.50	3.52
	12–13	7.54	8.00	1.64	1.26	0.67	0.62	0.52	.....	0.55	.....	10.12	10.22	2.92	2.10	2.33	2.11	1.64	.....	2.20	.....
Mexican	8– 9	5.84	2.19	1.98	1.40	0.48	0.57	1.36	0.74	1.03	0.51	11.45	4.20	4.12	2.92	1.84	2.23	4.97	2.71	4.84	2.34
	9–10	4.19	6.29	1.70	1.84	0.67	0.80	0.48	1.11	0.63	1.12	7.37	11.58	3.39	3.72	2.53	3.06	1.67	3.95	2.83	5.02
	10–11	5.06	5.66	1.64	2.19	0.57	0.98	0.82	0.50	1.23	0.86	8.29	9.34	3.17	4.27	2.10	3.63	2.81	1.71	5.36	3.67
	11–12	5.00	8.87	1.58	2.19	0.58	1.06	1.24	1.62	0.82	1.85	7.57	13.38	2.96	4.10	2.09	3.79	4.13	5.46	3.39	7.61
	12–13	7.13	8.02	1.95	1.79	0.86	0.92	0.95	0.70	0.74	1.16	10.03	10.67	3.54	3.22	3.04	3.17	3.04	2.24	2.96	4.44
	13–14	8.28	5.69	2.31	1.26	1.14	0.94	1.58	1.17	1.00	1.06	10.59	6.84	4.06	2.19	3.91	3.14	4.90	3.66	3.89	3.88
	14–15	10.46	4.26	1.89	1.30	1.31	0.56	1.55	.....	1.68	.....	12.09	4.79	3.19	2.22	4.32	1.81	4.58	.....	6.29	.....
Negro	7– 8	6.38	5.00	2.10	1.75	0.66	0.72	.....	.....	.....	.....	13.63	11.53	4.47	3.80	2.65	2.99	.....	.....	.....	.....
	8– 9	4.62	7.10	2.05	2.60	0.70	1.06	0.11	1.41	0.34	1.27	8.69	14.69	4.18	5.44	2.74	4.28	0.38	5.17	1.57	6.04
	9–10	7.77	8.41	2.52	2.55	0.85	1.01	1.11	0.78	1.00	0.93	13.45	15.17	4.93	5.06	3.24	3.91	3.85	2.72	4.55	4.17
	10–11	5.96	10.29	1.62	3.17	0.61	1.27	1.33	1.73	1.30	1.24	9.09	16.12	3.02	5.99	2.25	4.73	4.44	5.87	5.66	5.34
	11–12	5.30	10.76	1.76	2.44	0.64	1.10	0.86	1.28	0.45	1.82	7.41	14.52	3.18	4.35	2.31	3.91	2.75	4.10	1.85	7.44
	12–13	8.08	10.83	2.03	1.99	0.69	1.02	1.20	1.14	0.95	1.45	10.52	12.76	3.56	3.40	2.43	3.52	3.73	3.51	3.84	5.52
	13–14	11.57	8.39	2.54	1.34	1.23	0.82	1.49	1.10	1.48	1.16	13.63	8.77	4.30	2.21	4.24	2.71	4.47	3.27	5.76	4.18
	14–15	9.95	3.92	2.26	0.87	1.17	0.63	1.31	0.31	1.08	0.93	10.31	3.77	3.67	1.41	3.87	2.03	3.76	0.89	3.98	3.22
	15–16	11.17	1.42	2.02	0.26	1.29	0.06	1.47	0.47	1.24	—0.09	10.50	1.31	3.16	0.41	4.10	0.19	4.07	1.34	4.39	—0.03
	16–17	5.56	3.33	1.19	—0.11	0.50	0.38	.....	.....	.....	.....	4.73	3.04	1.81	—0.17	1.53	1.20	.....	.....	.....	.....

amount of growth, just as they are then approximately equal in skeletal differentiation; the relatively large gains of the girls from 10 to 12 years are followed by increments which after 12 to 13 years are either absolutely smaller than those of the boys or else the difference in favor of the growth of the girls is decreased. Departure from this general similarity occurs first in that negro boys and girls are not equal in growth in shoulder width between 9 and 10 years but they are then more nearly equal than in any other year of growth and Mexican boys and girls have their most nearly equal increment between 10 and 11 years; second, approximately equal growth in shoulder width occurs at 8 to 9 years and in hip width from 8 to 10 years among white boys and girls, and among Mexican, from 10 to 11 years in weight and shoulder width, instead of between 9 and 10 years; third, prior to 9 years of age the increment to standing height is less, instead of more, for Mexican girls than for Mexican boys.

The foregoing analyses show that the mean annual changes in each of the five body measurements as related to age and sex were on the whole strikingly similar for the three races. The rate of increase was much faster in weight than in any other measurement and the variability in weight much the greatest, the coefficient of variation being 2 to 3 times that in shoulder width and hip width and 3 to 4 times that in standing height and sitting height for corresponding groups. The lighter weight of girls than boys under 9 or 10 years and over 14 or 15 years and heavier weight of girls between these age limits are evidently characteristics of sex. In standing height and in sitting height, boys and girls differed as in weight, but to a less marked degree. Boys of all age groups (with few and unimportant exceptions) had a very slightly greater shoulder width than girls; girls after 8 or 9 years of age had a greater hip width than boys, with the differences increasing after 10 or 11 years. Differences between negro boys and girls were somewhat better defined than in the other two races in terms both of absolute units of measurement and in variability. There is evidence of a likeness between the relative annual rates of growth of boys and girls and their skeletal maturation with relation to age.

Mean Measurements for Race Groups According to Sex and Age

The data in Table 3 have been used also to show relationship between race groups according to sex and age. To facilitate comparison of the race groups, the graphs of mean measurements on a semi-logarithmic scale are presented in Figures 6 and 7. Here, for each measurement the boys of the three race groups are shown as one set of graphs and the girls as another set.

Relative Size and Rates of Increase in the Five Body Measurements

Weight. The younger white children, boys from 7 to 9 years and girls from 7 to 10 years, are heaviest of the three race groups; beyond

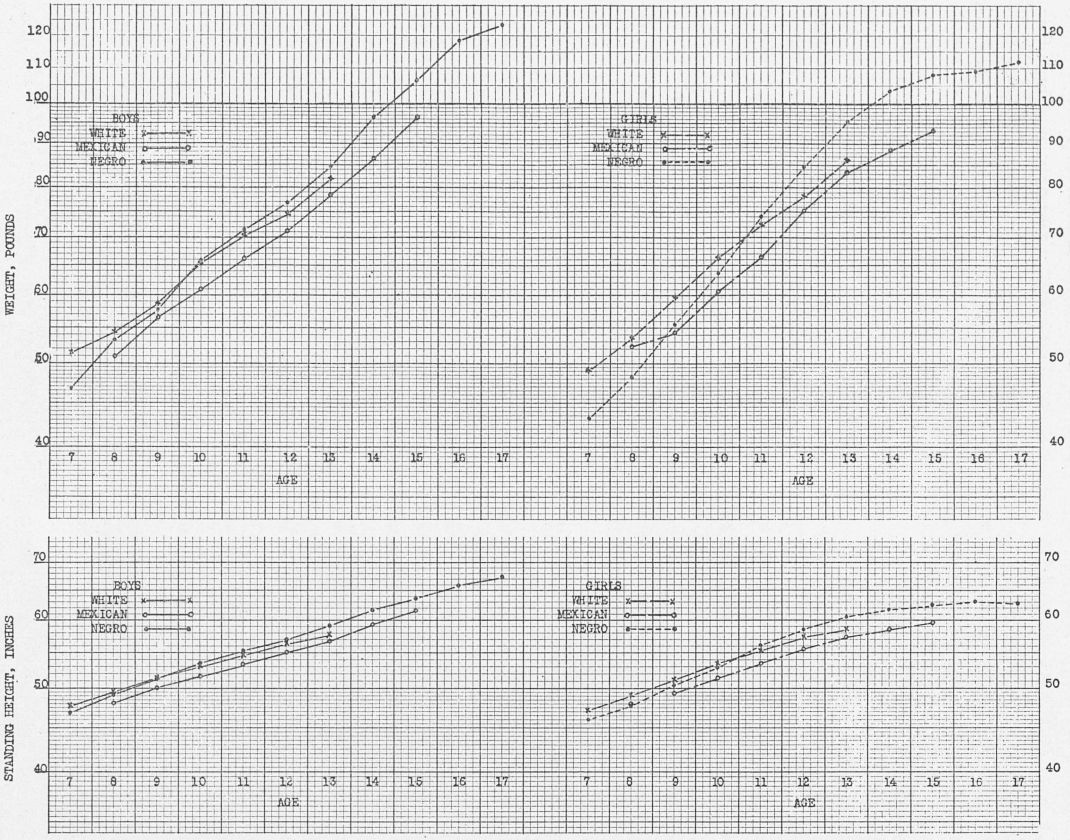

Fig. 6. Mean weight and standing height at each year of age for the boys and for the girls in each of the three race groups. The steeper the slope of the line the faster the rate of increase.

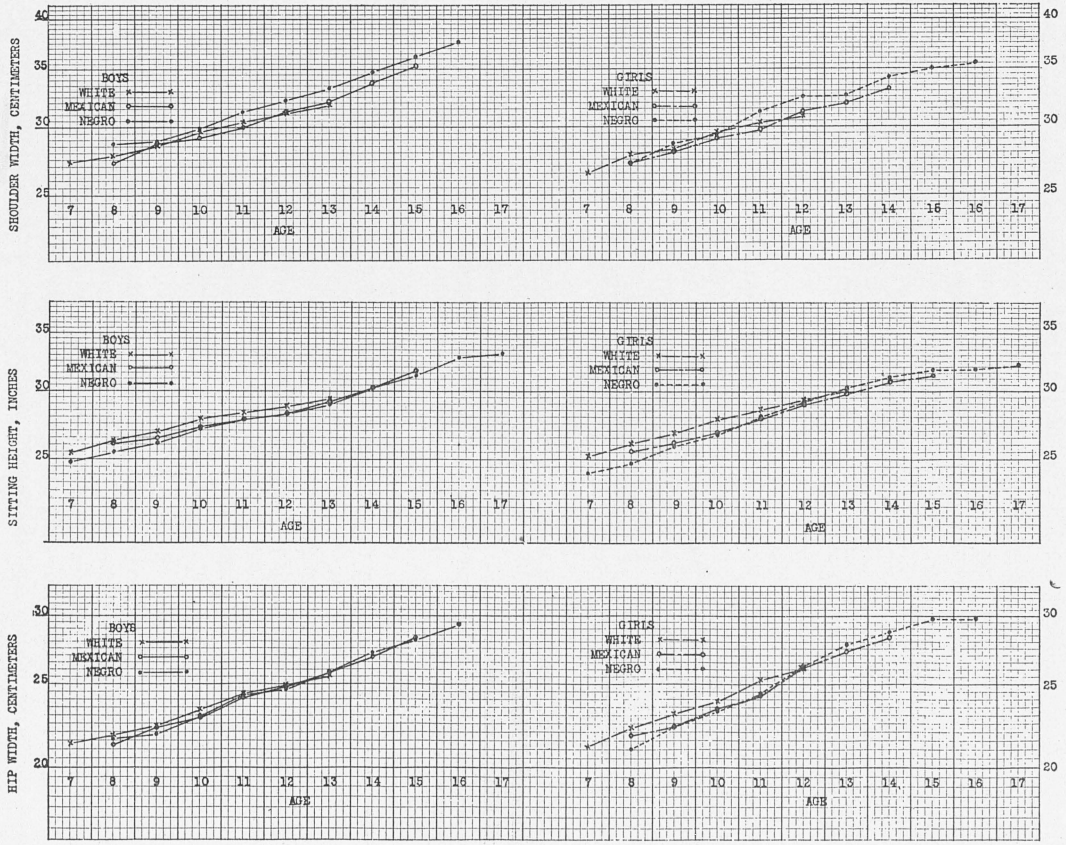

Fig. 7. Mean sitting height, shoulder width, and hip width at each year of age for the boys and for the girls in each of the three race groups. The steeper the slope of the line the faster the rate of increase.

these ages the white children are heavier only than the Mexican. The weights of the negro children fall between those for white and Mexican children through the 9-year group for the boys and for the 9-year and 10-year groups for the girls; but after 9 years for boys and 10 years for girls the negro children are heaviest of the three races.

The weight of negro children increases the most rapidly with age, the line for both boys and girls of this race group being more nearly vertical than for corresponding groups in the other two races. White and Mexican children have very similar rates of growth in weight, as shown by the nearly parallel lines for them, the only conspicuous deviations being from 11 to 12 years when the line for white boys and for white girls tends toward the Mexican line, and for the girls from 8 to 9 years when the Mexican rate is the slower.

Standing Height. The comparative pictures of the standing heights of the three race groups as shown by the graphs are a repetition of those for weight. White children are the tallest up to 9 years for boys and 10 years for girls, but thereafter white children exceed in stature only the Mexican. Negro children, who are shorter than the white, but taller than the Mexican under 9 years for boys and at 9 years and 10 years for girls, are, in higher age groups, taller than both white and Mexican children.

The rate of increase in stature is therefore fastest for negro children. White and Mexican children grow about equally slower than do the negro up to 11 years for boys and 12 years for the girls when the white children's rate is slightly slower than is that of the Mexican, as shown by the more nearly horizontal line for the white children.

Shoulder Width. Negro children, in general, have the greatest shoulder width, their superiority in this dimension over both the other race groups being consistent and clear cut from 10 years and over for the boys and from 11 years and above for the girls; also the 8-year-old negro boys and 9-year-old negro girls exceed the corresponding white and Mexican groups. White and Mexican children have very close values for shoulder width in the same age groups, with the exceedingly slight advantage to the white boys at 8, 10, and 11 years and the white girls from 8 to 11 years.

Relative rates of increase in shoulder width for the three races bear certain resemblances to those for weight and standing height—the Mexican and white children's rates are quite similar to each other, while that of the negro is fastest, but only from 9 to 11 years for boys and 8 to 11 years for girls; upper age groups of negroes have a rate which nearly parallels that of the Mexican children.

Sitting Height. White children have the greatest sitting height in all age groups except for the 13-year-old girls, who are barely exceeded by the negro. The negro children are shorter than the Mexican as well

as the white under 10 years, but above this age Mexicans and negroes are of practically the same sitting height.

The curve for negro children being slightly and continuously more vertically inclined than that for the white children indicates for the negroes a slightly faster rate of increase in sitting height. Under 10 years, the rate for negroes very slightly exceeds that for the Mexican children, but nearly coincident lines for Mexican and negro groups from 10 years on show the same rate of increase.

Hip Width. Boys of the three races have closely similar hip widths, the means being nearly identical at each age from 11 years onward. The girls of the three races have the same mean hip width only at 12 years. From 8 to 11 years inclusive, white girls have greater hip width than those of the other two races which closely resemble each other in this dimension, although Mexican girls slightly exceed the negro at 8 years, and the negro slightly exceed the Mexican at 13 and 14 years.

The boys of the three races have the same rate of increase in hip width from 11 years on; before this age the rates differ exceedingly little from each other and are very slightly faster than for the higher ages. Negro girls increase in hip width very little faster than do Mexican girls, and white girls have a slightly slower rate than do the other two race groups.

Significance of Difference Between Mean Measurements

The differences between mean measurements in relation to the probable error are shown in Table 7 for the boys and for the girls of each race group compared with each of the other two race groups at corresponding ages.

In these data the most striking and consistently occurring significant differences are those between negroes and Mexicans. For weight, standing height, and shoulder width together, there are only nine age groups out of 47 that do not show a significant difference between mean measurements for these two races. In contrast, hip width shows no significant difference, and sitting height shows it in only three of 16 age groups.

For white children compared with Mexican, significant differences are the rule for weight, standing height, and sitting height, there being but 10 age groups of 36 that do not have critical ratios of three or more. In hip width, white and Mexican boys have a significant difference in one of six age groups, and the girls differ significantly in three of five age groups. In shoulder width these two races have very similar means, only one (the 11-year girls) of 11 age groups having a difference which is significant.

With white and negro groups, only in sitting height do both boys and girls show significant differences to be the rule, there being but three of 14 age groups which do not differ significantly. The girls, but not the boys, show significant differences in nearly all age groups for weight,

standing height, and hip width. White and negro boys differ significantly in weight in but one age group, in standing height in two age groups, and in hip width at no age. Shoulder width of white and negro boys differs significantly in four of six age groups, of girls in two of the five age groups.

Table 7. Significance of difference between mean measurements of race groups

Race groups compared	Age, years	Difference of mean ÷ probable error of difference*									
		Weight		Standing height		Sitting height		Shoulder width		Hip width	
		Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
Negro minus Mexican	8	2.44	*3.02*	*3.34*	0.73	*4.00*	*6.23*	*5.07*	0.11	1.61	2.44
	9	1.12	1.37	*4.95*	*5.44*	2.60	2.91	0.46	2.52	1.45	0.09
	10	*5.66*	*3.36*	*9.79*	*9.39*	0.87	1.22	*3.41*	1.30	0.31	1.11
	11	*7.24*	*8.45*	*9.68*	*13.35*	0.44	1.80	*6.00*	*6.95*	0.71	0.81
	12	*6.99*	*9.47*	*10.63*	*15.37*	0.17	2.20	*4.19*	*5.67*	1.39	0.67
	13	*6.19*	*9.59*	*9.55*	*16.42*	1.36	*3.00*	*4.19*	*6.79*	0.19	1.72
	14	*7.79*	*11.83*	*10.59*	*14.55*	0.46	1.91	*3.47*	*4.73*	1.76	1.71
	15	*6.13*	*9.50*	*9.31*	*10.26*	1.25	1.87	2.05	.....	0.53	.....
White minus Mexican	8	*5.01*	1.09	*6.64*	*4.41*	2.00	*3.75*	2.33	1.15	2.65	1.83
	9	2.69	*6.67*	*7.63*	*11.56*	*4.22*	*8.56*	0.94	0.67	1.00	*3.84*
	10	*6.48*	*7.19*	*10.57*	*14.71*	*6.13*	*9.63*	2.44	2.61	*3.83*	*3.00*
	11	*6.85*	*7.80*	*10.86*	*10.71*	*6.20*	*6.78*	2.56	*3.89*	1.57	*5.16*
	12	*3.85*	2.80	*6.58*	*6.83*	*3.33*	*3.15*	0.14	1.91	0.05	0.10
	13	2.61	1.39	2.94	2.19	1.50	0.34	1.35	.....	0.67	.....
White minus Negro	7	*4.50*	*4.94*	2.60	*3.37*	*3.35*	*10.00*	.....	.....	.....	.....
	8	1.77	*8.55*	2.13	*7.42*	*6.00*	*14.00*	*4.19*	1.95	0.42	*7.39*
	9	1.55	*6.76*	0.95	*5.12*	*7.11*	*12.11*	1.17	2.23	2.30	*3.95*
	10	0.36	2.59	2.24	2.06	*6.33*	*9.78*	1.80	0.77	2.93	*3.79*
	11	1.04	1.62	1.68	*4.05*	*6.44*	*3.91*	*4.25*	*3.76*	0.63	*4.05*
	12	2.45	*5.44*	*3.50*	*4.92*	*6.33*	1.46	*4.33*	*7.00*	1.44	0.52
	13	1.95	4.36	*3.63*	*4.31*	2.57	0.69	*4.97*	.....	0.54	.....

*Quotients of 3 or more, almost certainly significant, and of 4 or more, certainly significant, are in italics.

On the basis of the picture given by the graphs in Figures 6 and 7 and the data in Table 7, the following generalizations may be made for the three races as represented by the children in this study.

Age for age Mexican children are lighter in body weight than either white or negro children; after 7 years, negro and white boys have nearly the same weight at a given age, but negro girls are considerably lighter in weight at 9 years and under and considerably heavier above 11 years than are white girls.

In total stature, Mexican children are the shortest of the three races. Negro boys after 9 years and girls after 10 years are a little taller than white children of the same sex, but the statures of negro and white boys at all ages are more nearly the same than is true for negro and white girls.

In sitting height, however, both negro and Mexican children who resemble each other, are shorter than are white children.

In shoulder width, negro children exceed both white and Mexican who resemble each other.

Hip widths of the boys of the same age in the three races are very similar; Mexican and negro girls are a little, and about equally, narrower in hip measurement than are white girls.

Comparison Between the Three Races for Boys and Girls Each as a Composite Age Group

Further comparison between the three races (boys and girls considered separately) is based on data for a composite age group including ages 8 to 12. This appeared desirable because of the larger numbers thus made available for new distributions with age limits held uniform for the three races, and because preliminary graphs drawn to show the variability of the 8-year to 12-year groups taken separately gave very similar polygons even for weight, which has the highest coefficients of variation. Such minor differences as appeared among the age groups were common to both sexes and the three races.

Variability in Mean Measurements

A graphic presentation of the comparative variability of the three races in each of the five body measurements is made in Figures 8 to 12 inclusive. These graphs are based on a transformation of the data as described by Pearl (31). The midpoint of each class in the distribution was expressed as a percentage of the mean. The mean having the value of 100, classes less than the mean have a value less than 100, and classes greater than the mean, a value more than 100. As an illustration, the Mexican girls had a mean weight of 65.10 pounds. Those whose weights fall in the class of 48 to 52 pounds (class interval five pounds, midpoint 50) are in the class which is 76.8% of the mean, while those weighing between 83 and 87 pounds are in the class which is 130.6% of the mean.

The frequency of each class (reduced to unity) was expressed as so much per 1,000 per 1% of the mean. Of the total 891 Mexican girls 8 to 12 years of age, there were 106 in the 48 to 52 pound class. This number (106) is equivalent to a frequency of 15.5 per 1,000 per 1% of the mean: $\frac{65.10 \times 106}{5 \times 100} = 13.8$; $\frac{13.8 \times 1000}{891} = 15.5$. By similar procedure the 35 girls in the class of 83 to 87 pounds were found to represent a frequency of 5.2 per 1,000 per 1% of the mean.

Thus the measurements were reduced to common terms, and are directly comparable. By use of the transformed data, plotting the distribution class values as percentages of the mean on the X axis and frequencies as their equivalents per 1,000 per 1% of the mean on the Y axis, the six frequency polygons (boys and girls separately in the three races) for each of the five body measurements are made to have the same area. The more flat and widespread the polygon the greater is the variability.

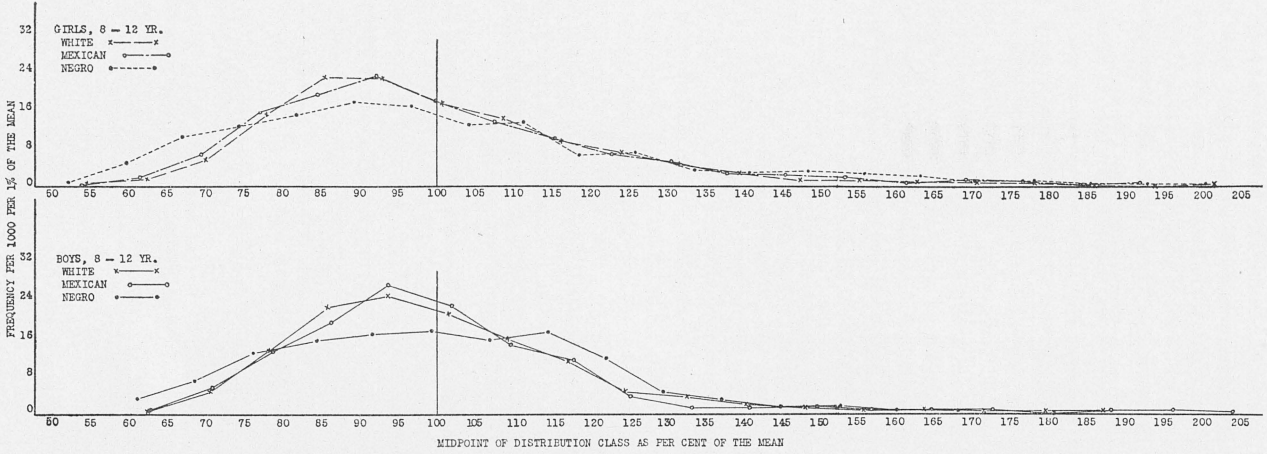

Fig. 8. Relative racial variability in weight of the boys and of the girls each as a composite age group. All polygons include equal areas; the more flat and widespread the polygon, the greater the variability.

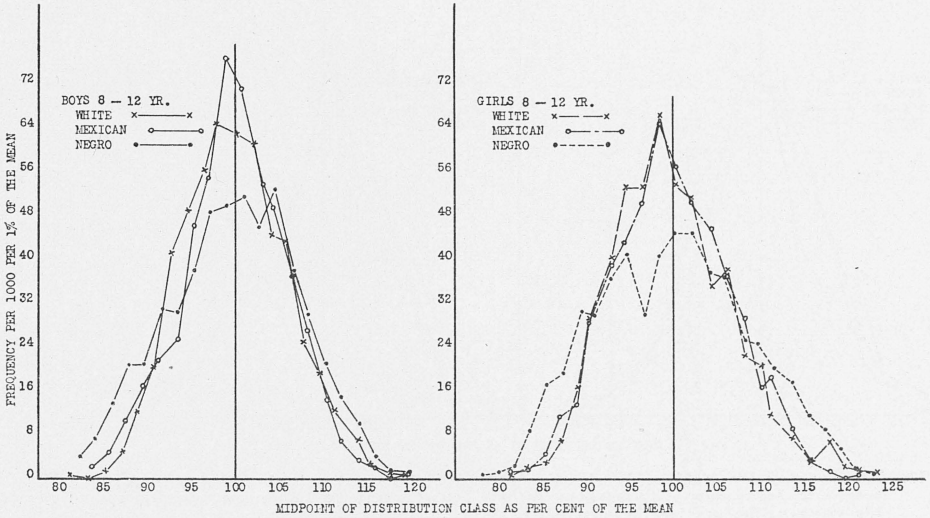

Fig. 9. Relative racial variability in standing height of the boys and of the girls each as a composite age group. All polygons include equal areas; the more flat and widespread the polygon, the greater the variability.

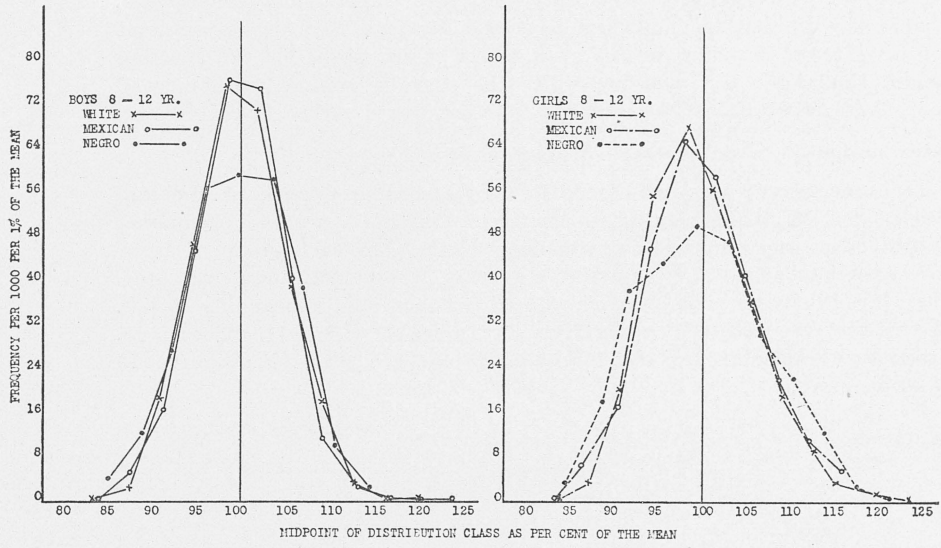

Fig. 10. Relative racial variability in sitting height of the boys and of the girls each as a composite age group. All polygons include equal areas; the more flat and widespread the polygon, the greater the variability.

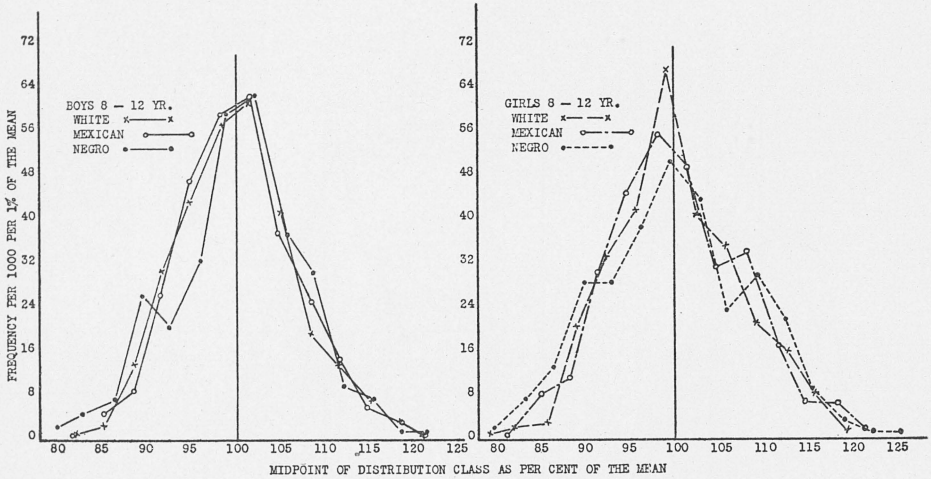

Fig. 11. Relative racial variability in shoulder width of the boys and of the girls each as a composite age group. All polygons include equal areas; the more flat and widespread the polygon, the greater the variability.

That the negroes are somewhat more variable than the other two races, which in general resemble each other, is readily seen among the girls in all five measurements, differences being greatest for weight and standing height. The greater variability of negro boys among themselves, compared with that among white boys and Mexican boys, is as apparent for weight and standing height as it is for negro girls; but with sitting height, shoulder width, and hip width the slightly greater variability of negro boys is much less well defined than for negro girls.

Interrelation Between Average Measurements

Each race group was subdivided in turn according to inch of standing height, inch of sitting height, centimeter of hip width, hip width/standing height index, and centimeter of shoulder width. For each group of 10 or more individuals in these classes, the average weight was then calculated. The average sitting height was calculated for each inch of standing height. The results are recorded respectively in Tables 8, 9, 10, 11, 12, and 13. Graphs corresponding to the foregoing tables are given in Figures 13 to 18 inclusive.

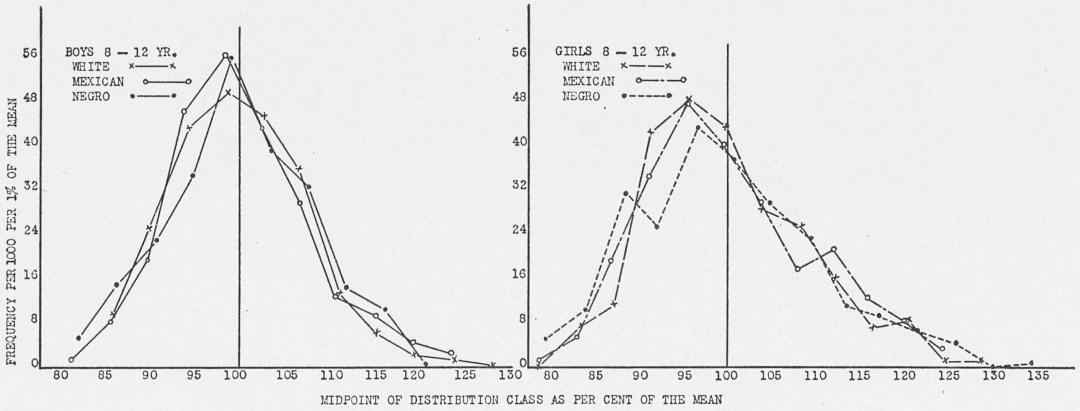

Fig. 12. Relative racial variability in hip width of the boys and of the girls each as a composite age group. All polygons include equal areas; the more flat and widespread the polygon, the greater the variability.

Table 8. Average weight for standing height in composite age groups

Height, inches	White				Mexican				Negro			
	Boys		Girls		Boys		Girls		Boys		Girls	
	No. cases	Lbs.	No. cases	Lbs.	No. cases	Lbs.	No. cases	Lbs.	No. cases	Lbs.	No. cases	Lbs.
42	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....
43	1	.....	1	.....	.....	.....	2	.....	.....	.....	2	.....
44	.....	.....	4	.....	3	.....	3	.....	5	.....	3	.....
45	4	.....	6	.....	7	.....	7	.....	9	.....	12	41.35
46	11	46.13	13	46.74	16	44.96	19	45.17	17	44.56	23	43.84
47	28	47.90	33	47.81	26	47.82	23	46.33	26	47.48	26	45.71
48	47	50.26	58	50.36	34	49.96	48	49.46	26	50.06	41	48.13
49	97	52.21	80	52.89	40	52.98	66	52.43	39	52.61	40	51.87
50	114	55.23	106	55.39	72	55.21	73	55.88	38	54.38	49	54.65
51	131	58.03	106	58.87	85	58.13	85	58.28	48	59.09	55	58.07
52	150	61.23	132	61.23	119	60.68	109	61.00	61	61.14	40	61.05
53	146	63.95	107	64.34	111	63.78	97	65.14	63	64.47	54	63.11
54	142	66.51	102	68.67	84	68.06	86	69.45	65	67.36	60	66.74
55	103	70.03	71	72 10	77	69.91	77	73.09	58	69.71	60	69.22
56	102	73.85	76	75 22	58	75.17	63	75.10	67	73.11	51	73.79
57	58	78.78	45	76.55	42	78.84	50	79.90	48	75.13	50	77.77
58	44	83.32	41	80.55	22	82.18	28	86.28	38	77.12	34	84.36
59	29	82.91	23	83.40	12	90.52	31	90.04	27	81.48	33	85.34
60	18	87.59	15	89.52	6	.....	15	92.29	19	87.94	27	90.45
61	6	.....	7	.....	3	.....	6	.....	13	88.70	24	91.60
62	2	.....	13	96.40	0	.....	2	.....	5	.....	16	99.62
63	1	.....	4	.....	1	.....	0	.....	2	.....	12	98.00
64	.....	.....	3	.....	.....	.....	1	.....	1	.....	8	.....
65	.....	.....	2	.....	.....	.....	.....	.....	.....	.....	2	.....
66	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....
Total	1234	.....	1048	.....	818	.....	891	.....	675	.....	724	.....

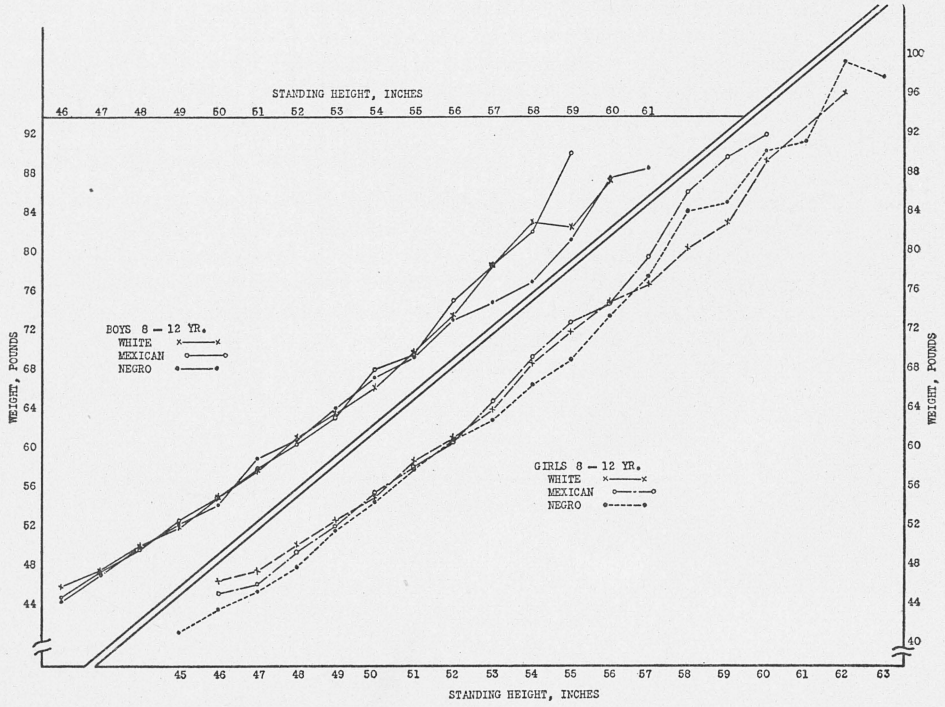

Fig. 13. Average weight for standing height of the boys and of the girls as a composite age group in each of the three races.

Table 9. Average weight for sitting height in composite age groups

Height, inches	White				Mexican				Negro			
	Boys		Girls		Boys		Girls		Boys		Girls	
	No. cases	Lbs.	No. cases	Lbs.	No. cases	Lbs.	No. cases	Lbs.	No. cases	Lbs.	No. cases	Lbs.
23	2	.....	1	.....	1	.....	1	.....	10	40.66	10	40.38
24	11	43.77	14	42.16	15	44.13	22	43.28	31	45.49	48	44.64
25	82	50.08	77	48.10	48	48.16	56	47.99	69	51.02	102	50.49
26	207	54.27	212	54.61	135	53.79	149	53.13	141	57.26	115	57.52
27	338	59.94	259	60.33	227	60.14	212	60.30	148	65.27	136	64.53
28	318	67.04	217	67.55	220	66.33	189	66.73	145	72.55	127	72.38
29	175	74.98	139	74.01	121	76.54	132	75.09	97	78.69	81	79.46
30	82	85.34	73	80.84	35	82.07	72	81.04	26	88.38	61	91.81
31	17	81.18	36	89.79	8	.....	38	90.06	7	.....	34	100.13
32	1	.....	14	94.79	2	.....	19	97.76	.....	.....	8	.....
33	1	.....	5	.....	1	.....	.....	.....	.....	.....	2	.....
34	.....	.....	1	.....	1	.....	.....	.....	.....	.....	.....	.....
Total	1234	.....	1048	.....	814	.....	890	.....	674	.....	724	.....

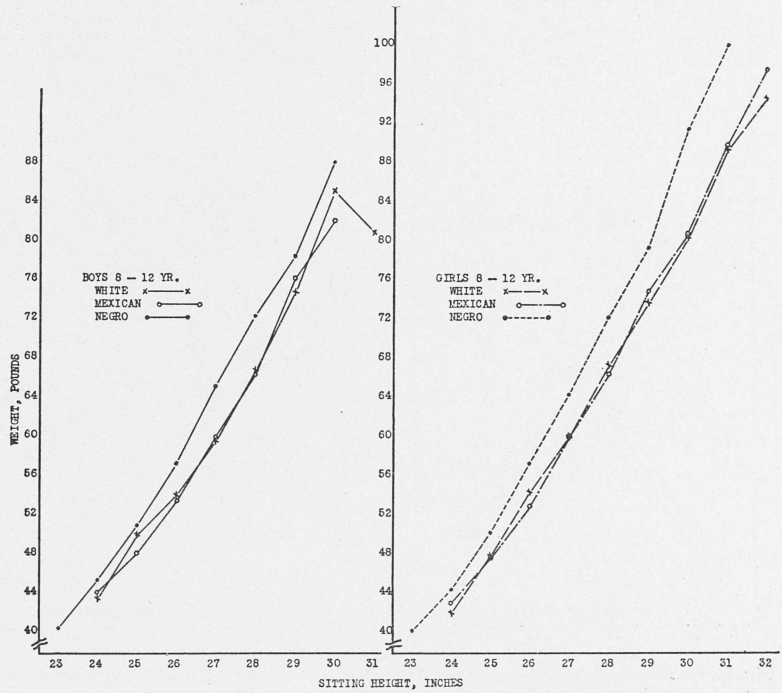

Fig. 14. Average weight for sitting height of the boys and of the girls as a composite age group in each of the three races.

Table 10. Average weight for hip width in composite age groups

Hip width, cm.	White				Mexican				Negro			
	Boys		Girls		Boys		Girls		Boys		Girls	
	No. cases	Lbs.	No. cases	Lbs.	No. cases	Lbs.	No. cases	Lbs.	No. cases	Lbs.	No. cases	Lbs.
19	.....	.....	1	.....	2	.....	2	.....	5	.....	6	.....
20	23	47.03	15	44.62	11	45.08	8	.....	16	46.44	12	44.15
21	61	51.97	22	50.31	26	49.84	26	49.24	24	51.39	36	51.00
22	103	56.42	83	54.55	61	55.39	47	55.00	36	57.88	29	57.27
23	119	62.22	95	60.20	74	59.90	66	58.59	58	64.69	50	61.39
24	108	68.64	85	65.49	57	66.09	55	62.74	41	71.64	43	67.91
25	86	74.40	56	71.50	39	71.02	41	69.89	34	76.38	34	73.33
26	32	82.98	50	78.22	17	75.67	24	73.52	15	81.28	27	81.79
27	16	90.40	32	83.48	12	87.67	30	83.13	11	93.09	13	88.49
28	6	.....	14	91.84	6	.....	17	87.84	1	.....	11	96.11
29	4	.....	16	102.79	3	.....	11	94.76	.....	.....	8	.....
30	1	.....	3	.....	.....	.....	5	.....	.....	.....	5	.....
31	.....	.....	3	.....	.....	.....	.....	.....	.....	.....	.....	.....
32	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....
Total	559	.....	475	.....	308	.....	332	.....	241	.....	275	.....

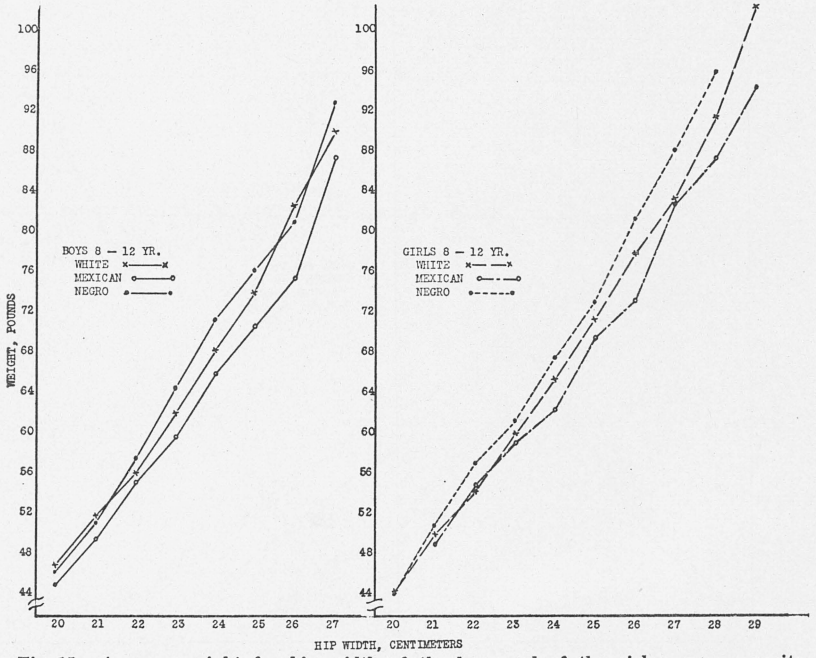

Fig. 15. Average weight for hip width of the boys and of the girls as a composite age group in each of the three races.

Table 11. Average weight for hip width/standing height index* in composite age groups

Hip width standing height index	White				Mexican				Negro			
	Boys		Girls		Boys		Girls		Boys		Girls	
	No. cases	Lbs.	No. cases	Lbs.	No. cases	Lbs.	No. cases	Lbs.	No. cases	Lbs.	No. cases	Lbs.
140	.....	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	.....
145	.....	.....	.....	.....	.....	.....	0	.....	.....	.....	.....	.....
150	1	.....	.....	.....	.....	.....	0	.....	.....	.....	2	.....
155	1	.....	3	.....	.....	.....	0	.....	2	.....	1	.....
160	28	60.76	11	57.50	3	.....	2	.....	17	70.75	15	60.25
165	93	60.42	35	57.74	15	58.33	20	56.25	60	62.40	43	59.40
170	143	63.09	82	60.72	79	58.05	45	56.33	73	62.82	70	63.15
175	157	64.89	111	62.55	105	60.96	65	60.54	48	68.46	55	66.73
180	82	67.60	115	67.67	65	67.32	85	62 95	34	70.44	47	71.43
185	39	75.63	59	71.69	24	69.27	47	69.64	5	.....	23	76.58
190	12	87.37	40	80.68	9	.....	38	74.58	1	.....	9	.....
195	1	.....	9	.....	5	.....	17	81.12	.....	.....	8	.....
200	1	.....	4	.....	1	.....	7	.....	.....	.....	.....	.....
205	1	.....	2	.....	1	.....	4	.....	.....	.....	.....	.....
210	.....	.....	3	.....	1	.....	0	.....	.....	.....	.....	.....
215	.....	.....	1	.....	.....	.....	1	.....	.....	.....	.....	.....
220	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
225	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	.....
Total	559	.....	475	.....	308	.....	332	.....	241	.....	275	.....

* Hip width in centimeters x 1000
standing height in centimeters

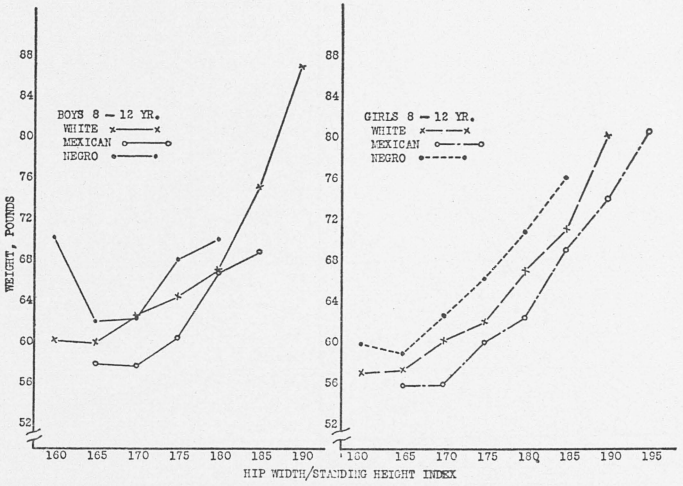

Fig. 16. Average weight for hip width/standing height index of the boys and of the girls as a composite age group in each of the three races.

Table 12. Average weight for shoulder width in composite age groups

Shoulder width, cm.	White				Mexican				Negro			
	Boys		Girls		Boys		Girls		Boys		Girls	
	No. cases	Lbs.	No. cases	Lbs.	No. cases	Lbs.	No. cases	Lbs.	No. cases	Lbs.	No. cases	Lbs.
23	.....	.....	2	.....	.....	.....	.....	.....	.....	.....	.....	.....
24	2	.....	4	.....	1	.....	1	.....	2	.....	2	.....
25	4	.....	5	.....	5	.....	9	.....	4	.....	7	.....
26	26	51.25	33	51.53	9	.....	13	49.63	6	.....	12	45.90
27	58	52.91	54	54.55	27	51.38	34	52.33	21	50.33	26	51.25
28	83	57.52	68	58.14	49	55.88	50	57.02	16	53.40	26	54.38
29	108	61.28	109	64.10	62	58.91	62	59.56	26	57.04	35	62.62
30	116	67.81	66	68.33	65	64.03	55	66.11	47	62.62	46	64.48
31	78	70.90	57	75.01	39	69.63	35	71.48	50	69.45	40	70.37
32	36	77.85	34	82.45	26	72.97	38	79.35	30	74.62	22	74.74
33	26	84.08	26	91.66	15	88.59	19	86.00	24	82.18	27	82.96
34	13	91.15	14	100.07	6	.....	7	.....	8	.....	20	92.46
35	6	.....	3	.....	3	.....	7	.....	6	.....	8	.....
36	2	.....	.....	.....	1	.....	2	.....	1	.....	3	.....
37	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	1	.....
38	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....
Total	558	.....	475	.....	308	.....	332	.....	242	.....	276	.....

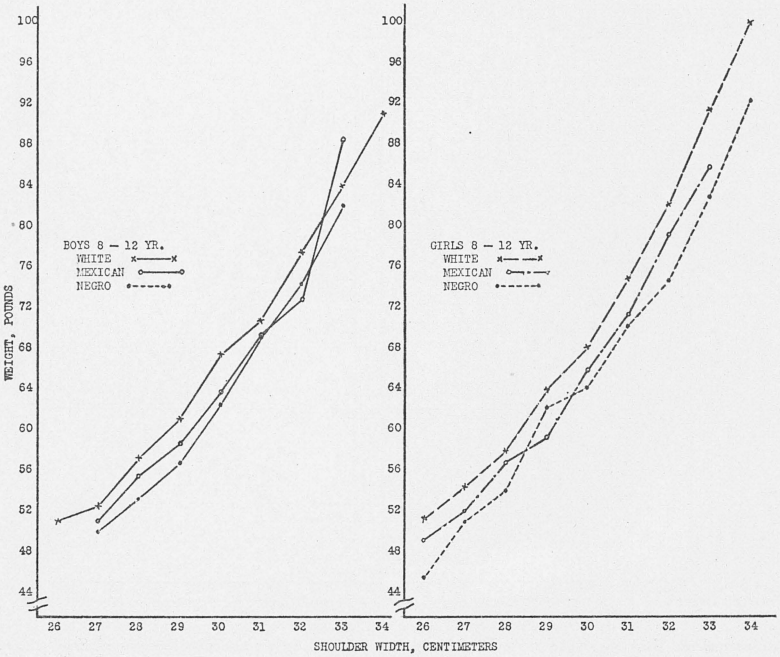

Fig. 17. Average weight for shoulder width of the boys and of the girls as a composite age group in each of the three races.

Table 13. Average sitting height for standing height in composite age groups

Standing height, inches	White				Mexican				Negro			
	Boys		Girls		Boys		Girls		Boys		Girls	
	No. cases	Inches	No. cases	Inches	No. cases	Inches	No. cases	Inches	No. cases	Inches	No. cases	Inches
42	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....
43	1	.....	1	.....	.....	.....	2	.....	.....	.....	2	.....
44	0	.....	4	.....	3	.....	3	.....	5	.....	3	.....
45	4	.....	6	.....	7	.....	7	.....	9	.....	12	23.97
46	11	24.70	13	24.93	16	24.83	19	24.65	17	24.25	23	24.23
47	28	25.10	33	25.17	26	25.22	23	25.20	26	24.68	26	24.46
48	47	25.43	58	25.62	34	25.62	47	25.51	26	25.08	41	24.98
49	97	25.93	80	25.98	40	25.93	66	26.08	39	25.44	40	25.28
50	114	26.35	106	26.35	71	26.41	73	26.50	38	25.87	49	25.65
51	131	26.78	106	26.75	84	26.80	85	26.82	48	26.14	55	26.13
52	150	27.19	132	27.16	119	27.22	109	27.22	61	26.64	40	26.45
53	146	27.56	107	27.59	110	27.57	97	27.69	63	26.81	54	26.91
54	142	27.95	102	27.98	84	27.95	86	28.18	65	27.33	60	27.29
55	103	28.26	71	28.52	76	28.34	77	28.56	58	27.72	60	27.60
56	102	28.63	76	28.93	58	28.69	63	29.12	67	28.03	51	28.08
57	58	29.20	45	29.37	42	29.19	50	29.67	48	27.73	50	28.49
58	44	29.53	41	29.91	22	29.59	28	30.25	38	28.64	34	28.99
59	29	29.97	23	30.11	12	30.10	31	30.75	27	29.11	33	29.26
60	18	30.25	15	30.97	6	.....	15	31.35	19	29.33	27	29.88
61	6	.....	7	.....	3	.....	6	.....	14	29.62	24	30.45
62	2	.....	13	31.66	0	.....	1	.....	4	.....	16	30.91
63	1	.....	4	.....	1	.....	1	.....	2	.....	12	30.92
64	.....	.....	3	.....	.....	.....	1	.....	1	.....	8	.....
65	.....	.....	2	.....	.....	.....	.....	.....	.....	.....	2	.....
66	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....
Total	1234	.....	1048	.....	814	.....	890	.....	675	.....	724	.....

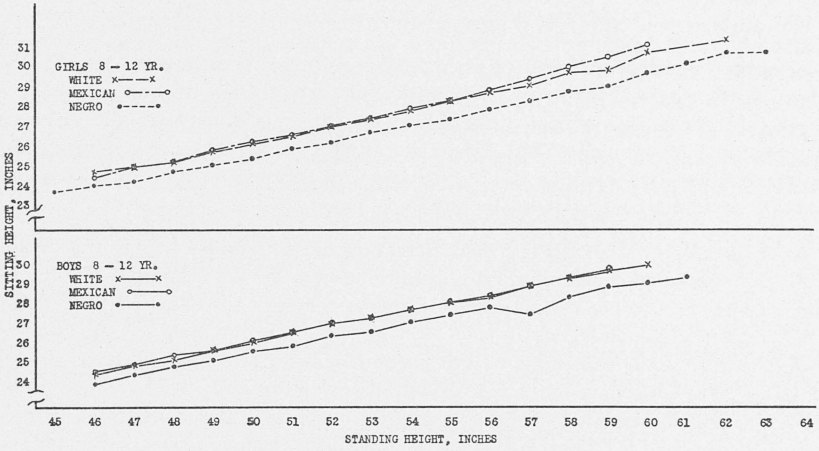

Fig. 18. Average sitting height for standing height of the boys and of the girls as a composite age group in each of the three races.

Average Weight for Standing Height. Among boys, the three races have very close average weight in each height class from 47 through 53 inches. In the range from 46 inches through 55 inches, the races interchange relative positions in the graph. But from 56 through 61 inches of height, well defined differences appear, the Mexican and white boys being about equally heavier than the negro at 57 and 58 inches, and at 59 and 60 inches the negro and white boys having close average weights below that of the Mexican boys. This irregularity in race positions in the upper height classes may be due in part to the smaller size of the groups; but it should be noted that there is a racial difference in weight among the girls of greater height, with numbers of cases comparable with those in lower height classes wherein average weights are of much closer value.

However, close similarity in average weight of the girls is less marked than for the boys. Resemblance among girls of the three races is closest between 49 and 52 inches of standing height. From 46 inches up to 52 inches of height (with exception of the 50-inch class) the white girls are the heaviest, the negro the lightest, and the Mexican between the other two races. From the 53-inch class to the 60-inch (except the 56-inch class) the Mexican girls' average weight slightly exceeds that of the white, and to a greater amount that of the negro. At 57 inches the average weight of white girls falls below that of the negro also and continues there to the end of the series at 62 inches.

Average Weight for Sitting Height. In contrast to the standing height to weight relationships, throughout the range of sitting heights the negroes have consistently a greater average weight for sitting height than either white or Mexican children, whose graphs are nearly coincident.

Average Weight for Hip Width. The relative positions of the three races with respect to average weight for centimeter of hip width are similar to those for weight referred to sitting height in that the negroes are heaviest in general; but they are different in that, in general, the white children are heavier per centimeter of hip width than the Mexican instead of being approximately equal to them.

Average Weight for Hip Width/Standing Height Index. For this analysis, the index was calculated by a method similar to one used by Lucas and Pryor (24) (whose landmark for measurement, however, was the iliac crest rather than the greater trochanter). The hip width in centimeters was divided by the standing height in centimeters and the quotient multiplied by 1000 to give a more convenient working figure. With reference to this hip width/standing height index the relative race positions correspond in general to those for average weight in relation to hip width, the negroes being heaviest, Mexican children lightest, and white children of intermediate weight.

Average Weight for Shoulder Width. With respect to shoulder width, the average weight of white children is greater (with one exception) in

each centimeter class than either of the other races. Negroes for the most part have less average weight than the Mexicans in the several classes of shoulder width, but twice with boys and twice with girls relative positions of Mexicans and negroes are interchanged.

Average Sitting Height for Standing Height. According to this index, the negro children are conspicuously shorter waisted relative to their own total stature than are Mexican and white children, graphs for negroes being continuously lowermost of the three races. The Mexican and white children closely resemble each other in sitting height to standing height relationship, although from 55 inches and over of standing height the Mexican boys are slightly longer waisted than are the white. The relatively short trunk and long legs of the negro compared with the white children in this study correspond to like differences reported by Davenport and Love (15) to have been found among the drafted men of these two races in the World War. This finding is also in agreement with that of Todd and Lindala (39) that among the stock-linked body dimensions long legs (arms also) are typically negroid. Their determinations were made upon 268 adult cadavera, 100 each of white and negro males, and 36 white and 32 negro females. These workers found also that the females of both races have relatively shorter limbs than the males. Similarly, among the Texas school children in this study the girls of all three race groups have age for age a greater percentage of their total stature in their sitting height than have the boys, and so girls must have relatively shorter legs than boys have. Only the 8-year Mexicans and 7-, 8-, and 9-year-old negroes fail to show this difference between boys and girls.

Considering the several interrelations of measurements in the foregoing analyses, the negroes are more definitely distinguished from the other two races than are the white and Mexican from each other—an expression in part, no doubt, of inherent racial differences. This racial differentiation is specially well marked and consistent with respect to average weight for sitting height, wherein the negroes are superior, and in sitting height for standing height, wherein the negroes are inferior, to the Mexican and white children, who are very similar to each other in both values. Negroes exceed the other two races in average weight with respect to hip width and hip width/standing height index, with the white next to them and the Mexican lowest of the three. Negroes have consistently a lower average weight for shoulder width than do white children, and with some irregularity they are also lighter in weight for shoulder width than are the Mexican children. The three races have values nearest each other in case of average weight for standing height, but for boys this likeness extends only between 47 and 53 inches of height and for girls between 49 and 52 inches. For greater standing heights negro boys are lighter in weight than are white and Mexican, and similarly for the girls to 56 inches of height, after which, to the 60-inch class, the negro girls' average weight is less only than that of the Mexican girls.

The relationships found between the body measurements made in this

study lend emphasis to the observation made by Boas (8) that each racial type probably has its own growth curve. They indicate that in so far as interrelation of three or more body measurements may be made a basis for judging the stage of development of growing children, as has been proposed by some recent workers (1, 4, 24, 44), separate standards are needed for different race groups (whether distinguished by nationality or stock). This need is not minimized by the well-recognized marked influence of environment upon growth (7, 8, 21, 22, 28), more favorable conditions being reflected in larger size in comparable age groups, and less variability accompanying a common environment. Establishment and general acceptance of standards for optimal body proportions and size must await the accumulation of a larger mass of exact data on body dimensions than now exists.

COMPARISON OF TEXAS SCHOOL CHILDREN WITH THOSE OF SCHOOL AGE IN OTHER STUDIES

White Children

The number of cases in this report is thought too small to be used alone for the construction of tables that include two body measurements referred to year-of-age—such as height and weight, as in the standard tables of Baldwin and Wood (5), or height and hip width, as advocated by Lucas and Pryor (24), and intended as a partial basis for judging the nutritive state of a growing child. But with the added evidence the findings in this study afford of the need for separate racial standards, these data may be used with those secured by similar technique by other workers in devising standards which employ the measurements made on Texas school children. Also, certain aspects of this study and those by some other workers upon school-age children lend themselves to interesting comparisons.

Weight for Sitting Height

The standard tables of Dreyer and Hanson (16), whose technique was followed in measuring sitting height, provided values for comparison with Texas children (composite age group 8 to 12 years) of this study respecting weight (nude) in relation to sitting height. The comparison is shown graphically in Figure 19.

The Dreyer standards and the average weights of these Texas boys are exceedingly close, especially from 26 inches to 30 inches of sitting height, with no difference as great as one pound, and only the last height class (31 inches) of but 17 cases showing a marked difference (12.39 pounds in favor of the standards). The Texas girls are continuously lighter in weight than the Dreyer standards, although the difference in the first three classes of sitting height (24, 25, 26 inches) is approximately only ¾ pound; but divergence of the two groups increases gradually from 2.16 pounds at 27 inches of sitting height to 7.37 pounds at 31 inches and 12.74 pounds at 32

inches (only 14 cases in the Texas group). A more slender build as indicated by lesser weight for sitting height appears to be characteristic of these Texas girls in comparison with the subjects used for Dreyer's tables; but the weight of these Texas boys is strikingly similar to Dreyer's standards.

Weight-Height-Age Status

For the purpose only of comparing with Baldwin-Wood values, the white children were divided into groups according to inch of standing height in each year of age, and the average weight for each such group of 10 or more individuals was calculated. These averages, together with the median nude weight for each inch-of-height class for each age in the Baldwin tables (4) of weight-height-age averages (nude) for American-born boys and girls of school age, and the difference between each two corresponding averages, are recorded in Table 14.

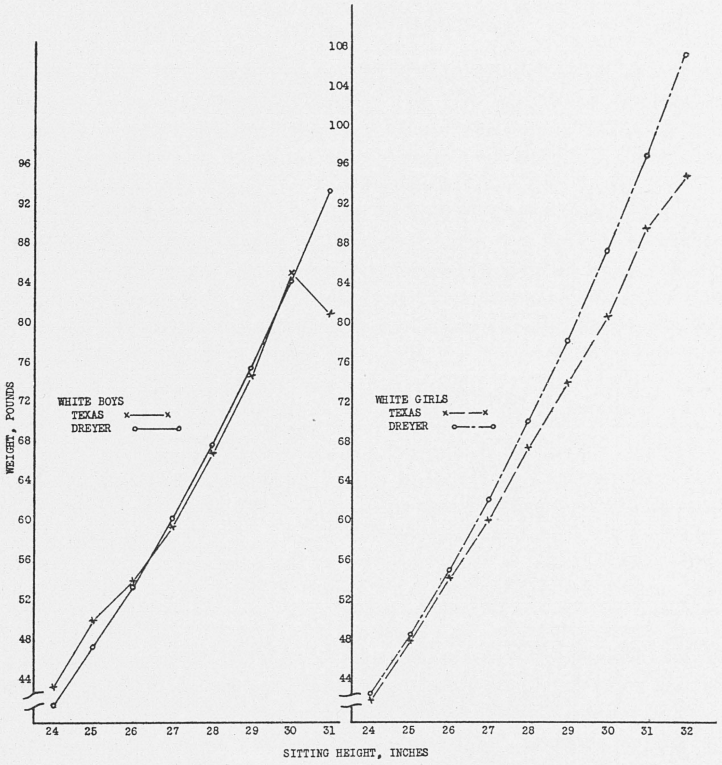

Fig. 19. Average weight for sitting height of Texas boys and girls, composite age groups 8 to 12 years, compared with the standards of Dreyer's Tables.

Table 14. Height-weight-age of Texas* white children versus Baldwin-Wood Average (weight, nude)

Height, inches	7 Years			8 Years			9 Years			10 Years			11 Years			12 Years		
	Texas	B-W°	Texas minus B-W	Texas	B-W	Texas minus B-W	Texas	B-W	Texas minus B-W	Texas	B-W	Texas minus B-W	Texas	B-W	Texas minus B-W	Texas	B-W	Texas minus B-W
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Boys																		
46	46.4	46.4	0.0															
47	48.6	48.3	+0.3	48.2	48.3	−0.1												
48	51.1	51.2	−0.1	50.5	51.2	−0.7	49.4	51.2	−1.8									
49	56.2	53.1	+3.1	52.5	53.1	−0.6	51.7	53.1	−1.4									
50	.....	.....	.....	55.4	55.7	−0.3	55.3	55.7	−0.4	54.0	55.9	−1.9						
51	.....	.....	.....	59.0	58.9	+0.1	57.4	58.9	−1.5	58.3	58.9	−0.6	58.0	58.9	−0.9			
52	.....	.....	.....	63.3	61.5	+1.8	61.2	61.5	−0.3	60.7	61.5	−0.8	60.3	61.5	−1.2			
53	.....	.....	.....	61.7	64.4	−2.7	64.4	64.4	0.0	64.7	64.4	+0.3	62.9	64.4	−1.5			
54	.....	.....	.....	.....	.....	.....	66.5	67.3	−0.8	66.7	67.3	−0.6	66.7	67.3	−0.6	66.4	68.3	−1.9
55	.....	.....	.....	.....	.....	.....	67.8	69.2	−1.4	70.8	70.5	+0.3	71.0	70.5	+0.5	68.9	70.9	−2.0
56	.....	.....	.....	.....	.....	.....	.....	.....	.....	74.0	74.0	0.0	73.8	74.0	−0.2	73.3	74.0	−0.7
57	.....	.....	.....	.....	.....	.....	.....	.....	.....	78.9	76.9	+2.0	79.2	77.9	+1.3	78.4	77.9	+0.5
58	.....	.....	.....	.....	.....	.....	.....	.....	.....	81.6	80.8	+0.8	82.6	81.2	+1.4	86.5	81.7	+4.8
59	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	85.0	84.6	+0.4			
60	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	88.0	88.6	−0.6			
Girls																		
45	42.7	43.7	−1.0															
46	46.5	45.6	+0.9	46.7	46.6	+0.1												
47	49.1	48.5	+0.6	47.5	48.5	−1.0												
48	50.6	50.9	−0.3	50.4	50.9	−0.5	50.2	50.9	−0.7									
49	53.7	52.8	+0.9	52.8	53.0	−0.2	53.5	53.5	0.0	52.0	53.5	−1.5						
50	.....	.....	.....	55.7	56.1	−0.4	55.9	56.8	−0.9	52.9	57.4	−4.5						
51	.....	.....	.....	58.4	58.2	+0.2	59.4	59.0	+0.4	58.8	59.3	−0.5						
52	.....	.....	.....	62.1	62.1	0.0	62.1	62.1	0.0	61.8	62.1	−0.3	58.5	63.1	−4.6			
53	.....	.....	.....	.....	.....	.....	65.4	65.2	+0.2	63.9	66.0	−2.1	64.5	66.0	−1.5			
54	.....	.....	.....	.....	.....	.....	65.4	68.5	−3.1	69.7	68.5	+1.2	69.8	69.3	+0.5			
55	.....	.....	.....	.....	.....	.....	.....	.....	.....	72.7	72.1	+0.6	72.2	72.1	+0.1			
56	.....	.....	.....	.....	.....	.....	.....	.....	.....	76.1	76.0	+0.1	76.0	76.0	0.0	74.9	77.1	−2.2
57	.....	.....	.....	.....	.....	.....	.....	.....	.....	78.0	80.4	−2.4	76.1	79.7	−3.6	77.9	80.5	−2.6
58	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	82.9	84.0	−1.1	78.2	84.0	−5.8
59	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	81.5	87.8	−6.3

*Average weight was calculated only for groups composed of 10 or more cases.
°B-W = Baldwin-Wood Tables.

The total number of Texas children used for this comparison for the ages 7 to 12 years inclusive were in order, for boys, 81, 210, 250, 310, 278, and 87; for girls, 105, 199, 214, 250, 169, and 53. Of the 82 differences (Table 14), 33 of them, or 40 per cent, are less than 0.5 pound; 23 per cent are from 0.6 pound to 1 pound; 21 per cent from 1.1 to 2 pounds; and the remaining 16 per cent from 2.1 to 6.3 pounds. In 56 cases the average weight of the Texas children is below the Baldwin-Wood value and in 26 cases above. Taking into account this 2 to 1 relationship of the + and — differences, the + and the — signs appear to be distributed in a fairly random fashion. It seems therefore that these Texas children are in general somewhat smaller than those children in cities of Pennsylvania, New Jersey, Maryland, Iowa, and in New York City, Chicago, and Washington, D. C., whose measurements were used by Baldwin and Wood.

Mean Weight, Standing Height, and Sitting Height for Age

The smaller size of these Texas children than Baldwin-Wood values is shown further by the graphs in Figure 20 for mean weight and mean standing height for age.

Since the mean standing heights of Texas school children referred to year of age were found to be nearer the Baldwin-Wood median heights (5) of medium tall children than for those classed as short or tall, the median heights for this medium tall group were used. As the smoothed values for weight (clothed) in the Baldwin-Wood Standard Tables were found to be less similar to the means in this study of Texas children than were the median nude weight values, for each age in the Baldwin-Wood tables of weight-height-age averages (nude) (4) the latter were used. The graphs of weight for Texas children show them to be heavier only at 7 and 8 years than the Baldwin-Wood median values; at 9 and 10 years for boys and 9, 10, and 11 years for girls the two sets of values are exceedingly close; and in older age groups the Texas children weigh increasingly less, up to 5.6 pounds at 13 years for boys and up to 10.7 pounds for girls.

The mean standing height of Texas children is continuously less than the Baldwin-Wood values (5). The difference for boys gradually increases from 0.11 inch at 7 years to 1.70 inches at 13 years; among girls differences range from 0.09 inch to 0.74 inch between 7 and 12 years, but at 13 years the Texas girls have a mean 2.14 inches less than the Baldwin-Wood standard.

In Figure 20 are also graphs for the mean weight, standing height, and sitting height of public school children reported in three other studies, one by Collins and Clark (14) of the United States Public Health Service with 28,674 pupils distributed among four geographic sections of the United States—northeast, north central, south central (Houston, Texas, included), and western; one by Meredith (27) with 1,243 boys of Iowa City; and one by Boynton (11) with 1,241 girls of Iowa City. The children measured by the Public Health Service ranged from 6 to 15 years in age and were

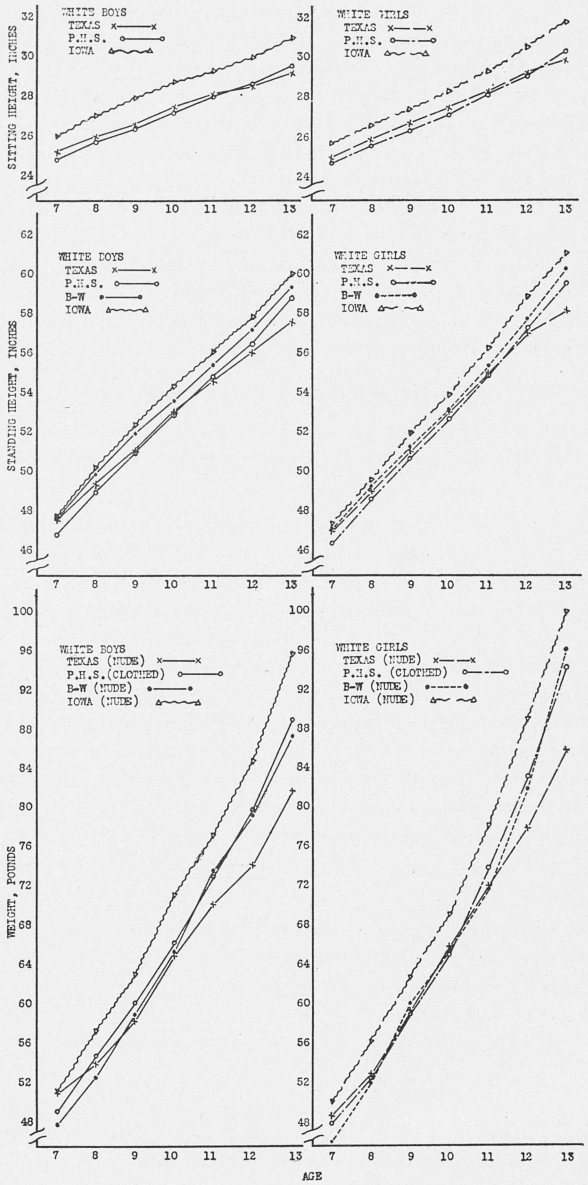

Fig. 20. Mean weight, standing height, and sitting height of white boys and of white girls 7 to 13 years of age as found in this study of Texas children, in a study by the U. S. Public Health Service of public school pupils in four geographic sections of the United States, and in Meredith's study of boys and Boynton's of girls in Iowa City. The median height of medium tall children and the median nude weight for each year of age in the Baldwin-Wood Tables are also shown.

all native-born third-generation white individuals, all four grandparents as well as the parents of each child having been born in the United States. Measurements of the Iowa City children—boys from birth to 17 years, girls from birth to 18 years—were taken from the records of the infant laboratory, preschool laboratories, elementary school, and high school of the University of Iowa. On the basis of information as to parents' birthplace and occupation for about 30% of the girls and 50% of the boys (all available), the authors judged these children to be of remarkably homogeneous racial stock and somewhat favored economically and culturally. Slightly over 50% of the known occupations were classed professional (mainly university faculty) or business proprietors, managers, and salesmen. The remainder were farmers, clerks, carriers, students, and laborers.

The same techniques were used for measuring standing and sitting height of the children in Iowa City, in San Antonio, Texas, and in the study by the Public Health Service; but weight for the children in the Public Health Service study included indoor clothing, while nude weights were determined for the children in Iowa City and in San Antonio. It is not known, however, whether the Iowa City children were weighed with urinary bladder empty as were those in San Antonio.

The mean weights of the boys in the study by the Public Health Service exceed those of Texas at all ages—by 0.8 pound to 1.98 pounds from the 8-year through the 10-year group, and the difference increases to an excess of 7.2 pounds at 13 years. But for the girls 7 to 10 years of age, those in the Public Health Service study weigh barely less than those in the Texas study (differences, 0.05 to 0.65 pound); at 11, 12, and 13 years Texas girls weigh less by 1.76, 5.06, and 8.39 pounds respectively. This comparison, however, cannot be clear cut because the weights of the children in the Public Health Service study are with clothing, those of the Texas children, nude. The median weight of individual indoor clothing of these Texas children was found (43) to be for girls approximately ¾ pound in winter and ½ pound in spring and fall months; for boys, approximately 1½ pounds irrespective of season. Individual weights of clothing varied greatly from the median. If similar or perhaps greater amounts of clothing were worn by the children of the Public Health Service study, most of whom lived in colder regions than Texas, it seems highly likely that both boys and girls in the Texas study were slightly the heavier in the 7 to 11 year old groups.

Mean nude weights of Iowa City children compared with those of San Antonio show a very different picture. Iowa City children are conspicuously heavier than those in San Antonio. With only the 7-year-old boys does the difference (Iowa City +0.32 pound) seem inconsequential. Other differences for the boys increase from 3.49 pounds at 8 years to 13.95 pounds at 13 years. Among girls, the Iowa City groups are heavier by 1.17 pounds at 7 years, and differences increase to 13.89 pounds at 13 years.

For standing height and sitting height, the consistently very close means for the Texas children and those in the study by the Public Health Service, particularly from 8 through 12 years, are especially impressive since the stock in the latter was entirely third generation United States citizens from four widely separated geographical sections, while the Texas group was not so rigidly selected for stock but all lived in the same city. The greatest differences in both standing and sitting height are at the extremes of the age group series, with the Texas children having larger means at 7 years and smaller at 13 years. The total stature of these Texas boys is greater by 0.85 inch, the girls by 0.55 inch at 7 years; but at 13 years Texas boys are 1.17 inches shorter, and Texas girls 1.39 inches shorter than those in the Public Health Service study. Differences for sitting height are +0.35 inch at 7 years and —0.35 inch at 13 years for Texas boys, and +0.26 inch at 7 years and —0.50 inch at 13 years for Texas girls.

Differences in standing height and sitting height between Iowa City and San Antonio children are no less impressive than with their weight. San Antonio children are the shorter in every age group both in total stature and sitting height. Difference in stature of but 0.10 inch for boys at 7 years increases to 2.46 inches at 13 years. Differences for girls increase from 0.40 inch at 7 years to 2.94 inches at 13 years. Differences in sitting height range from 0.84 inch at 7 years to 1.83 inches at 13 years for the boys; from 0.76 inch at 7 years to 1.98 inches at 13 years for the girls. Apparently most of the difference is in the stem length; indeed, for 7- and 8-year-old boys and girls sitting height differences are greater than are the differences in total stature. Iowa City children of these ages therefore appear to be relatively longer of trunk and shorter of leg than those in San Antonio.

The question arises as to whether the San Antonio children were a truly representative sample, although the schools were selected by the supervisors to be representative of the white school population. The generous courtesy of Dr. Carroll E. Palmer* of the Public Health Service has made it possible to apply statistical test of the typicalness of the San Antonio group. He has kindly supplied a copy of the original records of weight, standing height, and sitting height of the 1,680 pupils in Houston, Texas, who were included in the south central group of the Public Health Service study. Calculations have been made of the means of these measurements. Differences in mean weights for the several corresponding age groups, 7 to 13 years inclusive, in Houston and in San Antonio are similar to those between the San Antonio children and the entire group in the Public Health Service study. While these differences cannot be taken at face value because clothed weights (Houston) are compared with nude weights (San Antonio), those below 11 years are probably largely due to differences in weight of clothing, only 2 of 8 differences between the group 7 to 10 years inclusive being statistically significant.

*Personal communication.

In sitting heights, as found by this Texas study and that of the Public Health Service, there are 7 of 14 differences significant (4 for boys, 3 for girls), the ratios of difference to P. E. ranging from 3.9 to 6.6. Significant differences in sitting height are not consistently placed in the age range of the groups, although the 2 upper ages of boys and 3 upper ages of girls do not differ significantly. This is in contrast to the mean standing height relationships of the Houston and San Antonio pupils. In standing height, only 7-, 12-, and 13-year-old boys show significant differences (3.8, 3.8 and 3.5 times P. E.), and only the 13-year-old girls (differences 3.1 times P. E.). Statistical evidence points to the San Antonio and Houston groups (8 to 11 years inclusive for boys and 7 to 12 years for girls) being similar samples of the public school population of Texas, at least with reference to standing height.

The direction of the differences found between Texas children and both the Baldwin-Wood standards and the Iowa City children is a bit surprising in view first, of the fact reported by Davenport and Love (15) that among 1,000,000 recruits between 21 and 30 years of age drafted for the World War, those from Texas were tallest of any state, and were nearly one inch taller than the national average; second, the generally accepted view that tallness evidences itself even in infancy—as worded by Wallis (41), if a child "is tall at two years of age, he is likely to be tall at twenty"; and third, the evidence of increasing stature as given by Gray (20) for boarding school boys, by Bowles (10), for Harvard University students over a period of 32 years, by Jackson (23) for freshman college women at the University of Minnesota compared with a similar group 18 years before, by MacKinnon and Jackson (25) for freshman men over a 30-year period at the University of Minnesota, and by Chenoweth (12) for freshman men and women in the University of Cincinnati over a 20-year period. On the other hand Boas (8) comments that children born during the period 1895-1917 exhibited change in bodily development paralleling the economic cycle, and that during unfavorable years stature is lower than in prosperous times. The children in this study who were 8 to 12 years of age were born between 1917 and 1923. Do these years represent a phase in the economic cycle that is reflected in the stature of these children who in the opinion of the elementary supervisors were representative of the public school population of San Antonio? Gould (19), in reporting the stature of college women in Newcomb College in New Orleans, makes the suggestion that there must be some environmental factor in the gulf coast region responsible for the more slender build (less weight for equal height), in comparison with women in northern colleges. Perhaps the superiority of even the medium height standards of Baldwin-Wood over this Texas group is largely an expression of the difference that economic strata may make. A large portion of the data used for the Baldwin-Wood standards is from measurements of children attending private or endowed schools, and as Gray (22) points out in the summary of his own studies and Roberts (34) in

citing studies of others, children of more favored socio-economic status average taller and heavier than those less favorably situated. Repetition of the same measurements as made in this Texas study, upon these **same** children at a later period in their growth would make a valuable addition to our now very scant knowledge of **individual** progress in reaching adult size.

Variability

Faber (17), using (clothed) weight and height measurements of 34,000 school children in San Francisco, determined variability in weight for height in the direction of both underweight and overweight as compared with Baldwin-Wood standards. Those children were found to vary increasingly with age in both sexes, and girls had a greater variability and a more rapid increase in variability with increasing age than did boys. These results upon weight for height accord with the findings in this Texas study in the greater variability and more rapid increase in variability of white girls than white boys with increasing years. (With negro children of Texas, as previously mentioned, the variability decreased with increasing age, and among Mexican children there was no consistent gradation of values).

The relative magnitude of variability in weight and height for Texas school children (weight variability fluctuating between approximately 3 and 4 times that for height) is similar to the findings by Robertson (35) upon 50 each of boys and girls in each year of age from 6 to 14 years in the schools of Oakland, California.

A greater variability in weight in the years of adolescence was found by Clark, Sydenstricker, and Collins (13) in their study of 14,335 white children of native parentage in Maryland, Virginia, North Carolina, and South Carolina. Among Texas children this tendency, not perfectly consistent however, was also noted.

Mexican Children

Material from the report by Manuel (26) upon the body measurements of 3,678 Mexican children in El Paso and Laredo, Texas, made in the spring of 1930 (while the collection of data for this study was in progress in San Antonio), and the Height-Age and Weight-Age Tables for Mexican children secured through the courtesy of the Secretary of Public Education of Mexico (18) have been used for comparison with the Mexican children in San Antonio. The data serving as basis for these comparisons are portrayed graphically in Figures 21 and 22.

The Mexican Secretary of Public Education advised that 200 cases each of boys and of girls for each year of age were subjects for observation of standing height and weight, and that allowance was made for the amount of clothing worn at the time of weighing. The figures in their tables therefore represent nude weights. In the study by Manuel (26)

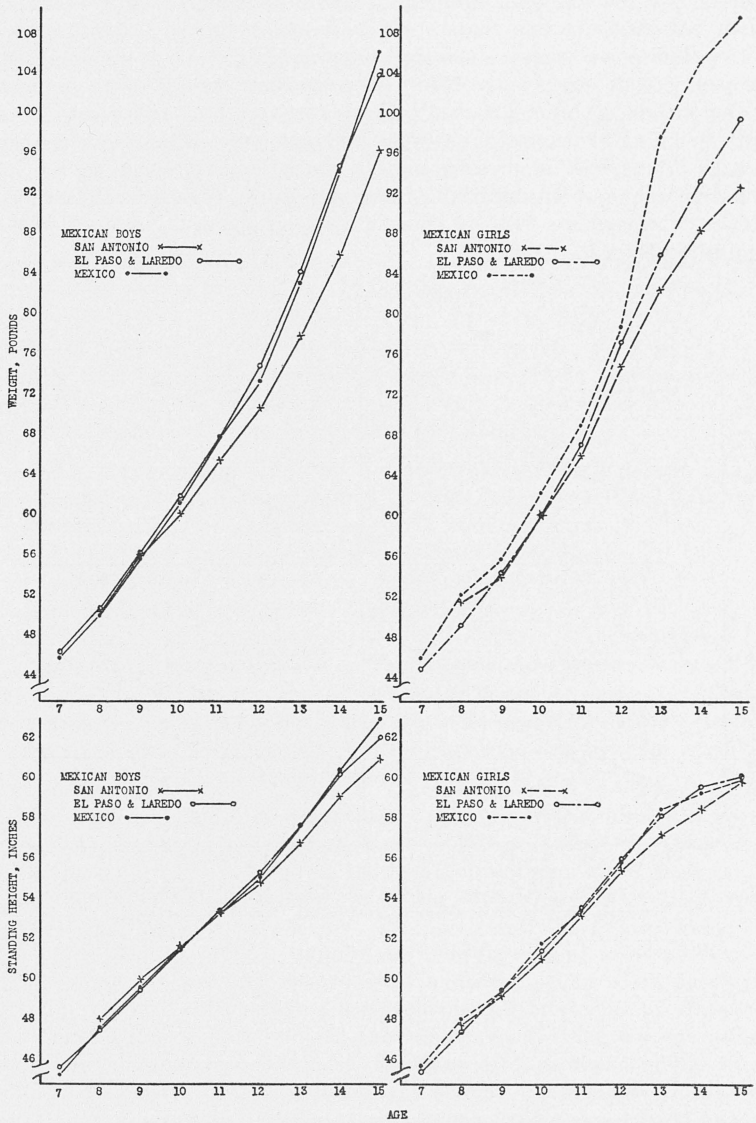

Fig. 21. Average weight and standing height for age of Mexican boys and Mexican girls in San Antonio, in El Paso and Laredo, and in Mexico.

the children were weighed in indoor clothing which, weighed for some of the children, ranged from ¼ pound to 1¼ pounds for girls and from ½ pound to 3 pounds for boys. The median clothing weight of Mexican boys in San Antonio was found (43) to be 1¾ pounds in a winter month and 1½ pounds in a spring and a fall month; for girls ¾ pound irrespective of season. Wide variations from these median values were numerous. Standing height in Manuel's study was taken at first with the stadiometer on the weighing scale, but later with a "rigid scale attached to a vertical screen or to a wall" and a try-square placed on the head of the child. The latter technique is similar to that used in the San Antonio study and as reported elsewhere (42) is considerably more accurate than with the weighing scale rod.

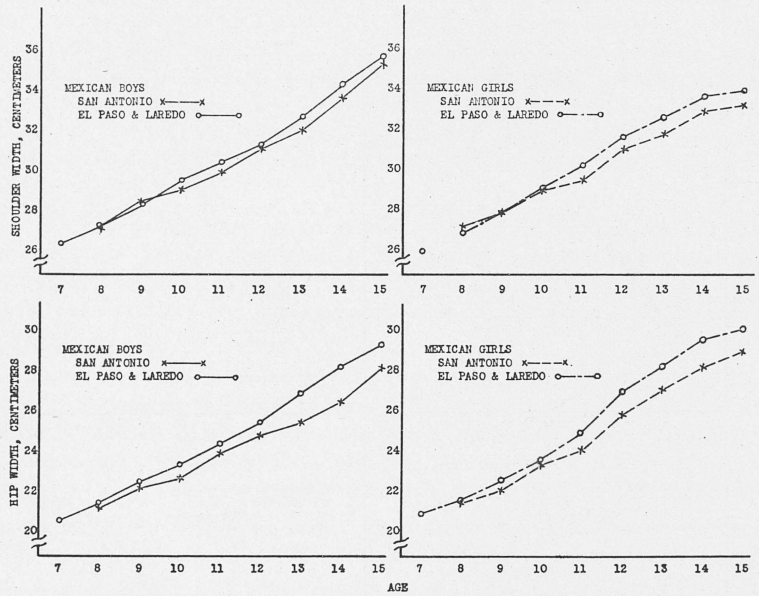

Fig. 22. Average shoulder width and hip width for age of Mexican boys and of Mexican girls in San Antonio, and in El Paso and Laredo.

As will be seen in the graphs, the weights (nude) of Mexican boys in Mexico and those in El Paso and Laredo (clothed) are quite close to each other, with El Paso and Laredo boys very slightly the heavier; and from 10 years onward, both other groups are heavier than Mexican boys in San Antonio. The greatest differences between the San Antonio and the El Paso-Laredo group is 8.9 pounds (at 14 years), and between the San Antonio and Mexico groups, 10 pounds (at 15 years). Between 7 and 11 years the San Antonio boys are lighter in weight by 0.3 pound to 2.3 pounds than the El Paso-Laredo boys, a difference less than the upper value of clothing weight worn by the El Paso-Laredo boys.

The mean weights among the girls of the San Antonio and the El Paso-Laredo groups are in general closer to each other than the weights of either group are to those of Mexican girls in Mexico. At 8 years, the San Antonio girls are 2.2 pounds heavier than the El Paso-Laredo; at 10 years the means of these two groups are identical; at other ages up to 13 years no difference is greater than 3.5 pounds, the figure by which Manuel reports the El Paso girls to have averaged more in weight than the Laredo girls. The 9-, 10-, and 11-year girls of the San Antonio group are no doubt heavier in weight than those in the El Paso-Laredo group, the differences in these age groups falling within the range of El Paso-Laredo girls' clothing weight.

Mexican girls between 8 and 12 years of age in San Antonio have a mean weight less by only 1.0 pound to 4.1 pounds than those in Mexico, but at 13 years the difference is 14.1 pounds, at 14 years 16.8 pounds, and at 15 years 17 pounds in favor of the girls in Mexico. Perhaps Manuel's suggestion that some selective factor tended to exclude the heavier girls from enrollment in the grades measured in the El Paso and Laredo study applies also to the enrollment in the San Antonio school.

In height, the means of the two groups of Mexicans in Texas and the one in Mexico are quite close from 8 through 12 years, the difference in case both of boys and of girls exceeding 0.5 inch only once (0.8 inch). The Mexican boys in San Antonio are shorter than those in Mexico by 0.9 inch to 2.0 inches from 13 to 15 years of age, and the San Antonio girls are shorter than those in Mexico by 0.8 inch and 1.3 inches at 13 and 14 years, respectively; but at 15 years, by only 0.2 inch. Paschal and Sullivan (30) report the average height for 100 each of 9-year-old boys and of girls and nearly as many 12 years old in Tucson, Arizona, to be 1 to 2 inches greater than for children of the same age in Mexico City. These workers give a mean height of 50.6 inches for Mexican boys and 50.3 for girls of 9 years, of 56.2 inches for boys and 56.9 for girls of 12 years.

The technique for measuring width of shoulders and of hips was similar in the two studies upon Mexican children in Texas in that the same landmarks were used; they differed in that wooden calipers were used for the El Paso and Laredo group, and metal calipers for the San Antonio. That there may also have been greater pressure employed in measuring the children in San Antonio is suggested by the position of the San Antonio graph for hip width—continuously below that for the El Paso-Laredo group, and similarly with the graphs for shoulder width from the 10-year group on. Taking into account that number of cases in the two studies were comparable only for the 11- and 12-year boys and the 10- to 13-year girls, and also the unknown, as well as the recognized probable differences in technique, the width of shoulders and of hips of the children in the two studies is probably similar. The greatest difference in shoulder width for the two groups of boys is 0.7 centimeter at 13 and 14 years, and for girls, 0.9 centimeter at 13 years. In hip width, the great-

est difference between the two groups of boys under 12 years of age is 0.7 centimeter (at 10 years), and after 12 years, 1.8 centimeters at 14 years. With girls, difference in hip width never exceeds 1.3 centimeters (this difference at 14 years), and up to 11 years the greatest difference is 0.9 centimeter (at 11 years). Of course, there is the possibility that Mexican children in different localities in Texas may differ in body dimensions, but without further observations with technique as uniform as possible in all respects, no such conclusion or surmise is legitimate.

Negro Children

Data taken from the most nearly comparable material found upon negro children are shown graphically in Figures 23 and 24, in comparison with corresponding findings for these Texas negroes. The group from Atlanta, Georgia, 5,148 children from 6 to 16 years of age inclusive, constituted the subjects in a study by Sterling (37) of the United States Public Health Service. These negroes were distinctly an urban group, only 6.6% having lived in a city less than 4 years, and 19% were second generation city-born. The study of Royster and Hulvey (36) dealt chiefly with urban negroes in Richmond and Charlottesville, Virginia, less than 100 of about 10,000 pupils 6 to 18 years old living in the country. Rural negro children 6 to 16 years of age, numbering 1,650 in Rutherford County, Tennessee, comprised a group, measurements for whom were reported by Mustard and Waring (29). Comparison of Texas negro children with those in one or more of these studies in Georgia, Virginia, and Tennessee is possible with reference to weight, standing height, and sitting height. Only with the Texas negroes were nude weights secured; in the other studies measurements were made in indoor clothing without shoes. Technique in measuring height in the other studies is not described in their respective reports.

The nearly coincident graphs of weight for the Georgia and the Texas boys and the closely similar graphs for the girls of 10 years and over are noteworthy. The greatest difference in average weight of the boys is 2 pounds and of the girls of 10 years and over 2.27 pounds, both at 13 years. The clothing of the Georgia children could easily account for all weights which are in their favor except for the 7-, 8-, and 9-year and possibly the 13-year girls. In fact, most of the differences are small enough, and some of them in favor of the Texas children's nude weight, so that a tendency to slightly heavier weight for age in the Texas group may be conjectured. The Tennessee (rural) negroes of both sexes probably are a little heavier than those of San Antonio, but among the boys 7 to 11 years of age the superiority in weight (2.24 pounds to 3.71 pounds) is likely but very little greater than the difference made by the clothing weight of the Tennessee boys.

Median weight of clothing of Texas negro boys has been found (43) to be 2 pounds in a winter and 1½ pounds in a spring and a fall month;

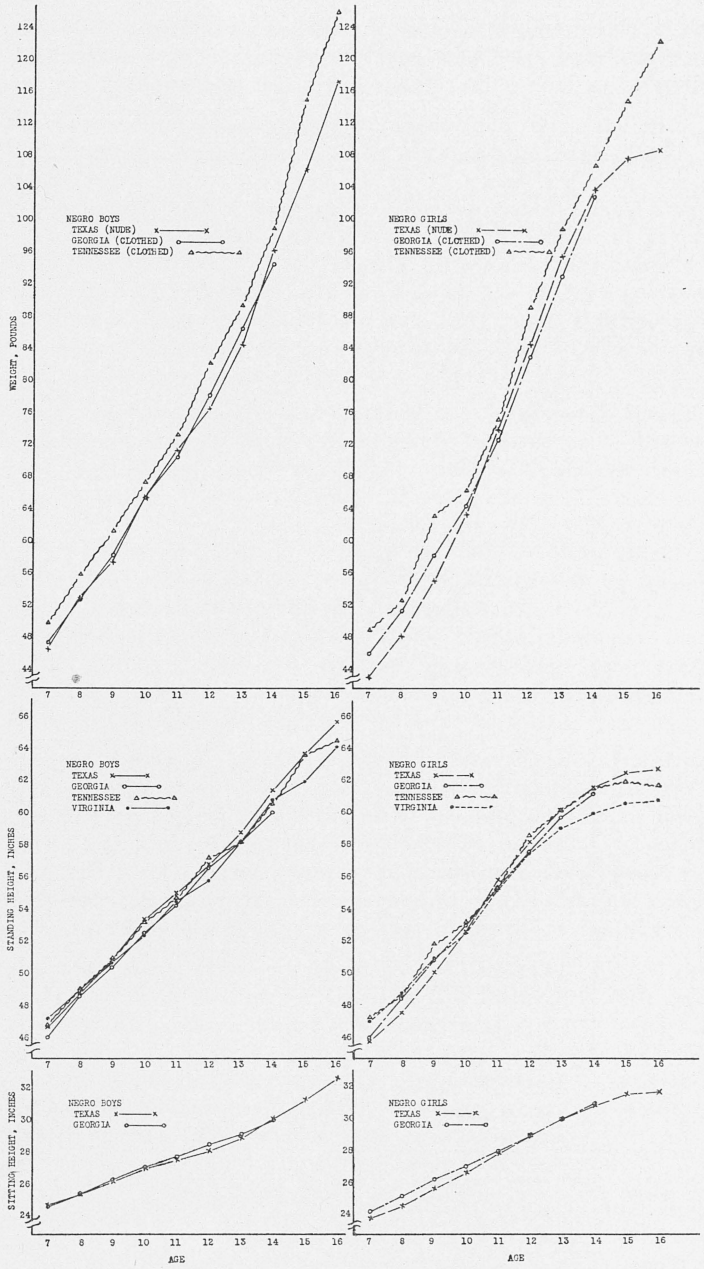

Fig. 23. Average weight for age of negro boys and of negro girls in Texas, in Georgia, and in Tennessee; average standing height for age of negro boys and girls in Texas, in Georgia, in Tennessee, and in Virginia; average sitting height for age of negro boys and girls in Texas and in Georgia.

for girls 1 pound in winter and $\frac{3}{4}$ pound in spring and fall. Variation from median values was even more marked than with white and Mexican children.

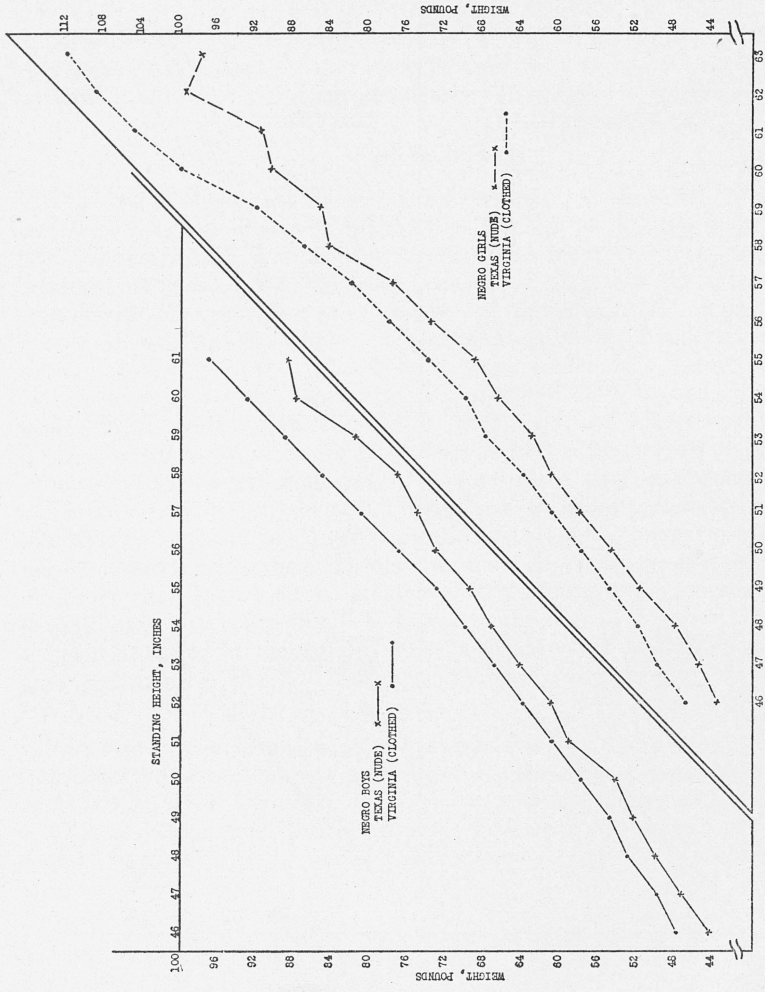

Fig. 24. Average weight for standing height of negro boys and of negro girls in Texas and in Virginia.

In standing height among negro boys 7 to 15 years, those from Texas and Tennessee have closely similar values (differences 0.02 to 0.70 inch), with slight advantage to the Texans in all but three age groups. The Georgia and Virginia boys resemble each other closely in stature and are shorter than Texas boys by 0.18 inch (at 12 years) to 1.35 inch (at 14

years) for the Georgia group, and by 0.33 inch (at 9 years) to 1.66 inch (at 15 years) for those of Virginia. At 7 years and 8 years, however, Virginia boys are 0.48 and 0.22 inch, respectively, taller than the Texas boys.

The standing height relationships of negro girls from the four states are not so consistently held throughout the series of age groups as is true for the boys. However, from 10 to 15 years inclusive, the Texas and Tennessee girls differ from each other by 0.03 to 0.57 inch, with those of Texas taller in 4 of 6 age groups; from 11 years on Texas girls are 0.35 to 0.62 inch taller than Georgia girls and taller than Virginia girls by 0.60 inch to 2.00 inches. In the age groups of girls younger than 10 years those of Texas are shortest, and those from Tennessee tallest, the latter having statures from 0.57 inch at 10 years to 1.72 inches at 9 years greater than the Texas girls.

In sitting height, Texas negro children are in general shorter than those of Georgia. Among boys, the difference is in favor of the Georgia group in all age groups except the 7-year; but the magnitude of the difference never exceeds 0.34 inch. With the girls, the divergence of values, beginning with 0.5 inch at 7 years, decreases from 0.70 inch at 8 years to 0.03 inch at 12 years, and at 13 years the Texas girls barely exceed those of Georgia (difference, 0.04 inch). The consistency in the slightly lesser values for Texas children, with exception as noted, may indicate a really shorter sitting height for the Texas negroes; but also, since the difference is so small, especially for the boys, perhaps some consistent but unknown difference in technique of measuring may be largely responsible for the variations in values.

The average weight for standing height irrespective of year of age, as shown in Figure 24, is uniformly greater for the Virginia than the Texas negroes. However, a great part if not all of the difference in the lower half of the series of inch-of-height classes (under 54 inches) is probably due to the clothing worn by the Virginia children when they were weighed. From 55 inches and above, the average weight of the Virginia children is probably really somewhat greater than that of the Texas children.

For all three races, this may be said: the foregoing comparisons reveal some remarkable similarities between the findings of this study of Texas children and other studies on comparable groups. Of the dissimilarities observed, some are due in large part to known differences in technique of measuring, some probably to difference in socio-economic class of the subjects measured, some to causes to which the studies themselves furnish no clue. More studies with techniques standardized and other conditions as uniform as possible are needed to determine the extent to which various factors affect growth of individuals of the same race in different localities and of different races in the same locality.

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SUMMARY

Data for this report upon the size, certain aspects of body build, and average rates of growth of Mexican, white, and negro school children were collected in the course of a project in which three public schools of San Antonio cooperated. The records for 928 white children 7 to 13 years of age, 790 Mexican children of 8 to 15 years, and 725 negro children from 7 to 17 years have been used. Over 2,500 measurements each of weight, standing height, and sitting height were made of the white and of the negro children, and over 2,300 of the Mexican. Measurements of shoulder width and of hip width totalled a little over 1,000 each for white children and a little under 1,000 each for the Mexican and for the negro children.

The mean for each of the five body measurements was calculated for each year of age for each sex in each race. In all cases, weight increased at much the fastest rate, followed in general in descending order by hip width, standing height, shoulder width, and sitting height.

The similarity of the changes as related to age and sex for each measurement for each race is striking. In weight, in standing height, and in sitting height girls at younger ages had smaller mean values than the

boys; but in all three races, between 9 and 10 years or 10 and 11 years, the girls gained advantage over the boys and held this position until 14 or 15 years, when means for the boys were again the greater. However, differences in standing height and sitting height between negro boys and girls were much more marked than for Mexican and white boys and girls.

For the most part, boys and girls of the same age in each race had nearly equal shoulder width. But in the few age groups in which the means were not the same, the slight difference was consistently in favor of the boys, except for 12-year and 13-year-old negro girls, who surpassed the boys.

Hip width was greater for white and Mexican girls 8 years of age and over for the negro girls 9 years of age and over than for boys of the same race and age. Differences between boys and girls were more pronounced from 11 years on for white children and from 12 years on for Mexican and negro, except at 16 years negro boys and girls had nearly the same hip width.

The boys and girls of the negro race were found to differ significantly from each other more often and more markedly than did white or Mexican, in weight, standing height, and sitting height. Shoulder width showed a significant difference of mean for only the 7-year white boys and girls, only the 9-year Mexican, and the 8, 16, and 17-year-old negroes. Hip width showed the most consistently occurring significant differences between boys and girls for the three races, these being in 5 of 7 age groups for the white children, in 4 of 7 age groups for the Mexican, and in 4 of 9 age groups of negro children.

The greater variability in general of girls than boys, and the more rapid increase of variability of girls with increasing age agrees with findings of Faber and of Robertson; the tendency to greater variability in weight between 10 and 14 years was somewhat less consistent than reported by Clark, Sydenstricker, and Collins.

Weight was by far the most variable measurement, the coefficients of variation being approximately 2 to 3 times as large as for shoulder width and hip width, and approximately 3 to 4 times those for standing height and sitting height in corresponding groups.

Negro and white children displayed directly opposite trends in relation of coefficients of variation in standing height to age, there being an increase in variability with age for white children and a decrease for negro.

The average annual weight gains for white children ranged from approximately 3 to 8 pounds; for Mexican, from 2 to 10½ pounds; for negro from 1½ to 11½ pounds. Larger weight gains between 10 and 14 years were much better defined for Mexican and negro children than for white. The annual gain for each race in standing height in most instances was roughly 2 inches and in sitting height roughly 1 inch, with slight advantage for the negro over the other two races. Annual gains in both shoulder width and

hip width for the most part fell between about ½ centimeter and 1½ centimeters, with somewhat larger proportion of the bigger gains among negro and Mexican than the white children.

The relative gains of boys and girls in these various measurements showed a general similarity to rates of skeletal maturation in relation to sex as determined by Todd. Gains of girls were in general greater than those of boys before 9 years of age; between 9 and 10 years the two sexes had approximately the same growth; the relatively large gains of girls from 10 to 12 years were followed by increments which after age 12 or 13 were either absolutely smaller than those of the boys or else the difference in favor of the girls was less than at earlier ages. This similarity between rates of skeletal maturation and growth in the five measurements included in this study is more consistent for white and negro children than for Mexican.

Compared with white children, negroes, before 9 or 10 years, were lighter in weight, and thereafter, heavier; in standing height, shorter till 9 or 10 years old and thereafter taller; in sitting height, continuously shorter from 7 to 12 years; broader through the shoulders after 8 years, and in hip width narrower, the differences being greater between girls than boys.

Compared with white children, Mexican children of the same age were lighter in weight, shorter in both standing height and sitting height, and slightly narrower through the hips and the shoulders.

Compared with negro children, Mexican children of the same age were lighter in weight, shorter in standing height, narrower in shoulder width, and similar in both sitting height and hip width.

On the whole, the rates of increase for white and Mexican children were quite similar in all five measurements—weight, standing height, sitting height, shoulder width, and hip width. In general, the rate of increase in the five measurements is fastest for the negroes, being especially marked with weight, but distinct for the other four measurements except among boys for hip width, in which the three races have nearly the same rates.

Considering interrelations of body measurements for all children from 8 to 12 years inclusive in each race, the negroes were more definitely distinguished from the other two races than were the white and Mexican from each other. This racial differentiation was specially well marked and consistent with respect to average weight for sitting height, wherein the negroes were superior, and in sitting height for standing height, wherein the negroes were inferior to both the Mexican and white children, who had values very similar to each other. Negroes exceeded the other two races in average weight for hip width and for hip width/standing height index, with the white children next to them and the Mexican lowest of the three. Negroes had consistently a lower average weight for shoulder width than white children, and with some irregularity they were also lighter in weight for shoulder width than the Mexican children.

The three races had values nearest each other in average weight for standing height, but for boys this likeness extended only between 47 and 53 inches of height and for girls between 49 and 52 inches. For greater statures, negro boys were lighter in weight than white and Mexican; negro girls from 53 to 56 inches were lighter than those of the other two races, but from 57 to 60 inches they weighed less than the Mexican girls only.

These findings add to the evidence of the need for separate racial standards for body measurements designed to be used as a partial basis for judging the nutritive and developmental state of a growing child, and provide some data which may be used for this purpose.

Texas white boys closely approximated Dreyer's standards of weight for sitting height in most height groups; but except for agreement in 3 height groups, Texas girls were lighter in weight than Dreyer's standards. These white children of Texas appeared to be somewhat smaller than Baldwin-Wood standards, as shown by weight-height-age status and mean weight for age. They were slightly shorter than the Baldwin-Wood standards for **medium height** children, but they remarkably resembled in both standing height and sitting height, public school children measured by the Public Health Service in four widely separated geographical sections of the United States, and also the children of Houston, Texas, who were in this study by the U. S. Public Health Service. Compared with children in Iowa City, these in San Antonio were considerably smaller in average weight, standing height, and sitting height.

The Mexican children in San Antonio up to 11 years were equal in weight or slightly heavier than corresponding groups in El Paso and Laredo. At all ages those of San Antonio weighed less than Mexican children in Mexico, the difference being negligible for the younger children, but increasing with age to 10 pounds for boys and 17 pounds for girls at 15 years. The standing height of Mexican children of San Antonio was approximately the same as of those in El Paso and Laredo, and in Mexico, up to 12 years but thereafter both groups of Mexicans in Texas were shorter than those of Mexico. Shoulder width and hip width of Mexican pupils in San Antonio and those in El Paso and Laredo were strikingly similar.

Negro children appeared approximately equal in weight to those of corresponding ages in Tennessee, and slightly heavier than those in Atlanta, Georgia. The standing heights of negroes of Texas, of Tennessee, of Georgia, and of Virginia were quite similar, with the differences, usually slight, in favor of the Texas negroes. The sitting height of Texas negroes was barely less than of those in Georgia. The lighter weight for standing height of the Texas negroes compared with those in Virginia was probably largely accounted for by the weight of clothing worn by Virginia negroes.

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